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Maximum Utilization of Water Resources in a Planned Community - Application of the Storm Water Management Model. Volume II: Appendices

Espey, Huston and Associates, Inc, Austin, TX

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16. ABSTRACT

A Management strategy for utilization of water resources in the planned community of The Woodlands, near Houston, Texas, was developed by modification and application of the EPA Storm Water Management Model (SWMM). Selected sites on Panther Branch, which flows through The Woodlands, and on Hunting Bayou, a completely developed watershed within the city limits of Houston, Texas were modeled for testing and verification of the modifications to the SWMM.

The capacity of the SWMM to model urban runoff quantity has been improved to include the "natural" drainage concepts of The Woodlands and the infiltration computation model in the SWMM is now capable of operating with a rainfall record which includes periods of zero rainfall. Three new subroutines generate normalized area-discharge curves for natural sections, model baseflow conditions, and model the operation of porous pavements, respectively. Verification of the SWMM with regard to suspended solids and BOD_5 was attempted and modifications to predict COD, Kjeldahl nitrogen, nitrates and phosphates were performed. This innovative water quality modeling scheme has proved very successful in predicting future effects of urbanization.

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MAXIMUM UTILIZATION OF WATER RESOURCES IN A PLANNED COMMUNITY

Application of the Storm Water Management Model

Volume II: Appendices

by

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9-1/8"

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FOREWORD

The Environmental Protection Agency was created because of increasing public and government concern about the dangers of pollution to the health and welfare of the American people. Noxious air, foul water, and spoiled land are tragic testimony to the deterioration of our natural environment. The complexity of that environment and the interplay between its components require a concentrated and integrated attack on the problem.

Research and development is that necessary first step in problem solution and it involves defining the problem, measuring its impact, and searching for solutions. The Municipal Environmental Research Laboratory develops new and improved technology and systems for the prevention, treatment, and management of wastewater and solid and hazardous waste pollutant discharges from municipal and community sources, for the preservation and treatment of public drinking water supplies and to minimize the adverse economic, social, health, and aesthetic effects of pollution. This publication is one of the products of that research; a most vital communications link between the researcher and the user community.

This project focuses on methods of maximizing the use of water resources in a planned urban environment, which minimizing their degradation. Particular attention is being directed towards determining the biological, chemical, hydrological and physical characteristics of storm water runoff and its corresponding role in the urban water cycle.

Francis T. Mayo
Director
Municipal Environmental
Research Laboratory

PREFACE

The overall goal of this research was to evaluate the water resource plan for The Woodlands, Texas, and to make recommendations, as necessary, to maximize its effective utilization through alterations in design and management. Any recommended alterations were to be critically evaluated as to their compatibility with the natural environment.

Collection and utilization of stormwater runoff for recreational and aesthetic purposes was a major feature of the water resources plan at The Woodlands. Control of downstream flooding was also of great importance and so storage reservoirs, in the form of recreational lakes and wet weather ponds, were created by the developers. Water quality was a concern if the impoundments were to be aesthetically appealing and/or suitable for recreation. Therefore, a major sampling and analytical program was designed to monitor water quality and quantity at different locations in the developing area. The Storm Water Management Model (SWMM) provided the focal point for combining the water quality and quantity data into a predictive tool for design and management purposes.

SWMM was originally developed for highly urbanized areas and, therefore, was calibrated for this project in an urban watershed (Hunting Bayou). Subsequently, SWMM was modified to model runoff and water quality from natural drainage areas, such as The Woodlands. Because of the lag in the construction schedule at The Woodlands, the dense urban areas were not completed during the project period. Consequently, Hunting Bayou and other urban watersheds were sampled to provide a basis for predicting pollutant loads at The Woodlands in the fully developed state.

Water analyses included many traditional physical, chemical and biological parameters used in water quality surveys. Pathogenic bacteria were also enumerated since the role of traditional bacterial indicators in stormwater runoff was not clear. Algal bioassay tests on stormwater were conducted to assess the eutrophication potential that would exist in the stormwater impoundments. The source, transport and fate of chlorinated hydrocarbons in stormwater runoff was also investigated.

Several of the large Woodlands impoundments will recieve reclaimed wastewater as the major input during dry weather. Besides their use as a source of irrigation water, the lakes will be used for non-contact recreation -- primarily fishing and boating. Because the reclaimed wastewater must be disinfected, there was a concern about disinfectant toxicity to the aquatic life in the lakes. Consequently, comparative fish toxicity tests were conducted with ozone and chlorine, the two alternatives available at the water reclamation plant.

Porous pavement was considered by the developers as a method for reducing excessive runoff due to urbanization and an experimental parking lot was constructed. Hydraulic data was collected and used to develop a model compatible with SWMM, to predict the effects of using porous pavement in development. Water quality changes due to infiltration through the paving were also determined.

Hopefully, the results of this project will contribute in a positive way to the development of techniques to utilize our urban water resources in a manner more compatible with our cherished natural environment.

ABSTRACT

Stormwater runoff from urban areas has been recognized as one of the major contributors to pollutant loadings in natural rivers, lakes and estuaries. To evaluate these loadings, characteristics of stormwater runoff from an urbanized area and an undeveloped site were quantified for several key water quality parameters at selected sites.

The Storm Water Management Model (SWMM) was modified to allow for modeling of 1) separate sewer systems, 2) effects of urbanization on baseflows, 3) performance efficiency of natural drainage systems, 4) cost efficiency of natural drainage systems, 5) four more water quality parameters - COD, Kjeldahl nitrogen, nitrates and phosphates, 6) hydrologic effects of porous pavement areas. A new subroutine was programmed for each of these objectives and included in the SWMM. All new subroutines are user options.

The resulting SWMM version can model storm periods separated by zero or low rainfall, eliminate all dry weather flow resulting from sewage, compute baseflow recessions, model flow in natural nonuniform cross-sectional channels, determine costs of natural drainage systems, model eight user selected water quality parameters for as many as 20 land uses, and evaluate the performance of porous pavement.

The SWMM was applied to the urbanized Hunting Bayou watershed in Houston, Texas, and Panther Branch, an undeveloped watershed where the new community of The Woodlands is being developed in its downstream reaches.

Because the original water quality predictions from SWMM verification and calibration runs were too low for urbanizing areas, a user option to input the actual loading rate and removal factor for each pollutant under consideration was introduced into the SWMM. This approach was verified by comparison to observed data on Panther Branch and Hunting Bayou and then applied to Swale 8, one of the tributary areas to Panther Branch, which is currently being urbanized. A management strategy to control storm water in a manner compatible with the natural environment and proposed natural drainage network was developed for Swale 8.

This report was submitted in partial fulfillment of Grant No. 802433 by Espey, Huston and Associates through Rice University under the sponsorship of the U. S. Environmental Protection Agency. This report covers the period from September 1, 1973, to September 1, 1976, and work completed as of September 1, 1976.

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D. Holloway

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APPENDIX A

```
*DECK,OVLY-1
      OVERLAY(RUN,0,0)
*DECK,SWMM3
      PROGRAM SWMM3(INPUT=65,OUTPUT=65,TAPE5=INPUT,TAPE6=OUTPUT,
     1                 TAPE7=65,TAPE8=65,TAPE9=65,TAPE10=65,TAPE11=65,
     2                 TAPE51=65,TAPE50=65,TAPE49=65,TAPE48=65,TAPE47=65)
C                                    STORMWATER MAIN PROGRAM
C=================================================================
C
      DIMENSION PNAME (7,2)
      COMMON /TAPES/ INCNT,IOUTCT,JIN(10),JOUT(10),NSCRAT(5)
      COMMON CNAME(2)
      DATA PNAME /4HRUNO,4HTRAN,4HRECE,4HENDP,4HSTOR,4HGRAP,4HCOMB,
     1            4HFF  ,4HSPOR,4HIVIN,4HROGR,4HAGE ,4HH   ,4HINE /
C
C*** ROUTINE FTNBIN IS A CDC SYSTEM SUBROUTINE USED TO PACK BINARY FILES
      CALL FTNBIN(1,0,IDUM)
      N5=5
      N6=6
      INCNT=0
      IOUTCT=0
      WRITE(6,80)
   80 FORMAT(1H1,/////,T11,'ENVIRONMENTAL PROTECTION AGENCY - STORM WATE
     1R MANAGEMENT MODEL  ***  RELEASE  II  ***',///,T16,'DEVELOPED BY',
     2T36,'METCALF + EDDY, INC,',//,T36,'UNIVERSITY OF FLORIDA',//,T36,'
     3WATER RESOURCES ENGINEERS, INC,',//,T16,'SEPTEMBER 1970',///,T16,'
     4UPDATED BY UNIVERSITY OF FLORIDA',//,T16,'FEBRUARY 1975',///////,
     5T36,'THIS IS A NEW RELEASE OF THE SWMM, IF ANY PROBLEMS',//,
     6T36, 'OCCUR IN RUNNING THIS MODEL PLEASE CONTACT WAYNE',//,
     7T36,'HUBER OR ALAN PELTZ AT THE UNIVERSITY OF FLORIDA,',//,
     8T36,'PHONE 1-904-392-0846',///////)
      READ(N5,100) (JIN(J),JOUT(J),J=1,10)
  100 FORMAT(20I4)
      WRITE(N6,110) JIN
  110 FORMAT(1H0,'TAPE  OR  DISK  ASSIGNMENTS'///,7X,'JIN(1)',4X,'JIN(2)
     1'4X,'JIN(3)',4X,'JIN(4)',4X,'JIN(5)',4X,'JIN(6)',4X,'JIN(7)',4X,'J
     2IN(8)',4X,'JIN(9)',3X,'JIN(10)'/,10I10,/)
      WRITE(N6,120) JOUT
  120 FORMAT(6X,'JOUT(1)',3X,'JOUT(2)',3X,'JOUT(3)',3X,'JOUT(4)',3X,'JOU
     1T(5)',3X,'JOUT(6)',3X,'JOUT(7)',3X,'JOUT(8)',3X,'JOUT(9)',2X,'JOUT
     2(10)',/,10I10,/)
      READ(N5,100) (NSCRAT(I),I=1,5)
      WRITE(N6,130) NSCRAT
  130 FORMAT(15X,'NSCRAT(1)',11X,'NSCRAT(2)',11X,'NSCRAT(3)',11X,'NSCRAT
     1(4)',11X,'NSCRAT(5)',/,5(10X,I10))
  135 DO 136 J=1,5
      IF(NSCRAT(J),EQ,0) GO TO 136
      NREWND=NSCRAT(J)
      REWIND NREWND
  136 CONTINUE
      IF(INCNT,EQ,0) GO TO 137
      IF(JIN(INCNT),EQ,0) GO TO 137
      NREWND=JIN(INCNT)
      REWIND NREWND
  137 IF(IOUTCT,EQ,0) GO TO 138
      IF(JOUT(IOUTCT),EQ,0) GO TO 138
      NREWND=JOUT(IOUTCT)
      REWIND NREWND
  138 READ(N5,140) CNAME
  140 FORMAT(20A4)
      WRITE(N6,150) CNAME
  150 FORMAT(1H1,/////,T11,2A4,' BLOCK CALLED',///)
      DO 240 I = 1,7
      IF(CNAME(1),NE,PNAME(I,1),OR,CNAME(2),NE,PNAME(I,2)) GO TO 240
      GO TO (260,280,300,340,360,380,400),I
  240 CONTINUE
      WRITE(N6,250)CNAME
  250 FORMAT('0 CORRECT CNAME NOT FOUND  ',2A4)
      STOP 1000
C 260 CALL RUNOFF
 260  CALL OVERLAY (3HRUN,1,0,6HRECALL)
      GO TO 135
C 280 CALL TRANS
 280  CALL OVERLAY (3HRUN,2,0,6HRECALL)
      GO TO 135
C 300 CALL RECEIV
 300  CALL OVERLAY (3HRUN,4,0,6HRECALL)
      GO TO 135
  340 WRITE(N6,34[illegible])
  345 FORMAT('1   STORMWATER SIMULATION ENDED')
      STOP 1111
C 360 CALL STORAG
 360  CALL OVERLAY (3HRUN,3,0,6HRECALL)
      GO TO 135
  380 CALL GRAPH(1)
      GO TO 135
C 400 CALL COMBIN
 400  CALL OVERLAY (3HRUN,5,0,6HRECALL)
      GO TO 135
      END
*DECK,ARSIN
      FUNCTION ARSIN(X)
      ARSIN = ASIN(X)
      RETURN
      END
*DECK,GRAPH
      SUBROUTINE GRAPH(IC)
C=======================================================================
      COMMON /TAPES/ INCNT,IOUTCT,JIN(10),JOUT(10),NSCRAT(5)
      COMMON X(201,5),Y(201,5),NLOC(100),YT(160,150),NPT(100)
     1,ITAB(101),IPLOT(200),DUMMY(50)
      COMMON/LAB/ TITL(18),XLAB(11),YLAB(6),HORIZ(20),VERT(7,6),IT,ICC
      ICC=IC
      IF(IC-1) 205,210,210
  205 READ(5,100) NPLOT,NPCV,NQP
  100 FORMAT(16I5)
      IF(NPLOT,EQ,0) RETURN
      NLP=NQP+1
      READ(5,100) (IPLOT(M),M=1,NPLOT)
      WRITE(6,106) NPLOT,(IPLOT(N),N=1,NPLOT)
  106 FORMAT(  '1HYDROGRAPHS WILL BE PLOTTED FOR THE FOLLOWING',I5,
     1' POINTS'/(10I10))
      IF(NPCV,LT,1) NPCV=1
      NTAPE=JOUT(IOUTCT)
      GO TO 220
  210 CONTINUE
      READ(5,100) NTAPE,NPCV,NQP,NPLOT
      NLP=NQP+1
      IF(NPCV,EQ,0) NPCV=5
      WRITE(6,102) NTAPE,NPCV
  102 FORMAT('1     OUTPUT WILL BE PLOTTED FOR TAPE',I5,'  IN BLOCKS OF
     1',I5)
      IF(NPLOT,LT,1) GO TO 212
      READ(5,100)(IPLOT(N),N=1,NPLOT)
      WRITE(6,106) NPLOT,(IPLOT(N),N=1,NPLOT)
  212 CONTINUE
      READ(5,104) TITL
  104 FORMAT(20A4)
      READ(5,104) HORIZ
      DO 1   JJJ=1,NLP
      READ(5,104) (VERT(II,JJJ),II=1,7)
    1 CONTINUE
  220 CONTINUE
      REWIND NTAPE
      IF(IC,LT,1) READ(NTAPE) TITL
      IF(IC,GE,1) READ(NTAPE) (DUMMY(I),I=1,20)
      READ(NTAPE) NSTEPS,NCURVE,NQUAL,TDELT,TZERO,TAREA
      WRITE(6,8000)
 8000 FORMAT(//,T7,'NSTEPS',T17,'NCURVE',T28,'NQUAL',T36,'TDELT',T46,
     1'TZERO',T56,'TAREA')
      WRITE(6,7091) NSTEPS,NCURVE,NQUAL,TDELT,TZERO,TAREA
 7091 FORMAT(3I10,3F10,1)
      NVAL=NCURVE*(NQUAL+1)
       IF(NVAL,LT,150) GO TO 402
       WRITE(06,400) NVAL
  400 FORMAT (' ','THE GRAPH SUBROUTINE IS ASKING FOR MORE OUTPUT FROM T
     *APE THAN THE DIMENSION OF  YT(160,150) ALLOWS,'/' ','A VALUE OF ',
     *I4,'HAS BEEN REQUESTED,  THIS ERROR RESULTED IN A SYSTEM BLOW-UP A
     *T STANFORD ON FORTRAN H, JUNE 1970, DAS'////)
       STOP
  402 CONTINUE
      READ(NTAPE) (NLOC(M),M=1,NCURVE)
      WRITE(6,8001)NCURVE
 8001 FORMAT(//,' STORED HYDROGRAPHS FOR THE FOLLOWING',I6,1X,'POINTS',/
     1)
       WRITE(6,7090) (NLOC(M),M=1,NCURVE)
      IF(NPLOT-1) 245,225,225
  225 K=1
      DO 240 M=1,NPLOT
      DO 230 J=1,NCURVE
      IF(IPLOT(M)-NLOC(J)) 230,235,230
  230 CONTINUE
  235 ITAB(K)=J
      K=K+1
  240 CONTINUE
      ITAB(K)=0
      GO TO 260
  245 DO 250 J=1,NCURVE
  250 ITAB(J)=J
      ITAB(NCURVE+1)=0
  260 CONTINUE
      MC=NSTEPS/100
      IF(MC*100,NE,NSTEPS) MC=MC+1
      ICOUNT=0
  270 N=1
      ICOUNT=ICOUNT+1
      IF(IC,EQ,3) TZERO=TZERO+NSTEPS/12,0*3600,0
      IF(ICOUNT,GE.2.AND.IC,EQ,2) TZERO=TZERO+NSTEPS/12,0*3600,0
      NR=0
      DO 300 K=1,NSTEPS,MC
      N=N+1
      DO 290 J=1,MC
      NR=NR+1
      IF(NR,GT,NSTEPS) GO TO 290
      READ(NTAPE) TIMES,(YT(N,M),M=1,NVAL)
  290 CONTINUE
      DO 295 M=1,5
      X(N,M)=TIMES/3600,
  295 CONTINUE
  300 CONTINUE
      DO 350 J=1,NLP
      IT=J
      K=1
      L=ITAB(1)                                                         GRAP 98
      DO 320 M=1,NCURVE,NPCV                                            GRAP 99
      IF(L,EQ,0) GO TO 330                                              GRAP100
      DO 310 MM=1,NPCV                                                  GRAP101
      IF(J-1) 301,301,302                                               GRAP102
  301 LX=L                                                              GRAP103
      GO TO 303                                                         GRAP104
  302 LX=NCURVE+(L-1)*NQUAL+J-1                                         GRAP105
  303 NPT(MM)=N                                                         GRAP106
      X(1,MM)=TZERO /3600,                                              GRAP107
      Y(1,MM)=0,0                                                       GRAP108
      DO 305 NN=2,N                                                     GRAP109
  305 Y(NN,MM)=YT(NN,LX)                                                GRAP110
      K=K+1                                                             GRAP111
      L=ITAB(K)                                                         GRAP112
      IF(L) 315,315,310                                                 GRAP113
  310 CONTINUE                                                          GRAP114
      NCV=NPCV                                                          GRAP115
      GO TO 318                                                         GRAP116
  315 NCV=MM                                                            GRAP117
  318 CONTINUE                                                          GRAP118
      ILAB=ITAB(K-1)                                                    GRAP119
      CALL CURVE(X,Y,NPT,NCV,NLOC(ILAB))                                GRAP120
  320 CONTINUE                                                          GRAP121
  330 CONTINUE                                                          GRAP122
  350 CONTINUE                                                          GRAP123
 7090 FORMAT(10I10)                                                     GRAP124
      IF(ICOUNT,NE,6,AND,IC,EQ,2) GO TO 270                             GRAP125
      RETURN                                                            GRAP126
      END                                                               GRAP127
*DECK,CURVE
      SUBROUTINE CURVE (X,Y,NPT,NCV,NPLOT)                              CURV  1
C=================================================================CURV  2
      DIMENSION X(201,10),Y(201,10),NPT(10)                             CURV  3
      COMMON/LAB/ TITL(18),XLAB(11),YLAB(6),HORIZ(20),VERT(7,6),IT,ICC  CURV  4
C                                                                       CURV  5
      XMAX=X(1,1)                                                       CURV  6
      XMIN=XMAX                                                         CURV  7
      YMIN=Y(1,1)                                                       CURV  8
      YMAX=YMIN                                                         CURV  9
      DO 205 L=1,NCV                                                    CURV 10
      NPTM=NPT(L)                                                       CURV 11
      IF(NPTM,EQ,0) GO TO 205                                           CURV 12
      DO 204 N=1,NPTM                                                   CURV 13
      IF(X(N,L),LT,XMIN) XMIN=X(N,L)                                    CURV 14
      IF(X(N,L),GT,XMAX) XMAX=X(N,L)                                    CURV 15
      IF(Y(N,L),LT,YMIN) YMIN=Y(N,L)                                    CURV 16
      IF(Y(N,L),GT,YMAX) YMAX=Y(N,L)                                    CURV 17
  204 CONTINUE                                                          CURV 18
  205 CONTINUE                                                          CURV 19
      RANGE=(YMAX-YMIN)/5,                                              CURV 20
      IF(RANGE,GT,0,) GO TO 2059                                        CURV 21
      IF(YMAX,GT,0,) YMIN=0,                                            CURV 22
      IF(YMAX,LT,0,) YMAX=0,                                            CURV 23
      RANGE=(YMAX-YMIN)/5,                                              CURV 24
 2059 CONTINUE                                                          CURV 25
      A=ALOG10(RANGE)                                                   CURV 26
      IF(A,LT,0,) GO TO 220                                             CURV 27
      N=A                                                               CURV 28
      RANGE=RANGE/(10,**N)                                              CURV 29
      L=RANGE+1,001                                                     CURV 30
  206 CONTINUE                                                          CURV 31
      IF(L,EQ,2) GO TO 209                                              CURV 32
      IF(L,GT,4) GO TO 207                                              CURV 33
      L=4                                                               CURV 34
  207 IF(L.GT.5) L=10                                                   CURV 35
 209 CONTINUE
     FRANG=L*10,**N
     GO TO 240
 220 M=A-0,9999
     N=-M
     RANGE=RANGE*10,**N
     L=RANGE+1,001
 226 CONTINUE
     IF(L,EQ,2) GO TO 229
     IF(L,GT,4) GO TO 227
     L=4
 227 CONTINUE
     IF(L,GT,5) L=10
 229 CONTINUE
     FRANG=L/10,**N
 240 CONTINUE
     K=YMIN/FRANG
     IF(YMIN,LT,0,) K=K-1
     IF(YMAX,LE,(K+5)*FRANG) GO TO 250
     L=L+1
     IF(L,LT,11) GO TO 245
     L=2
     N=N+1
     IF(A,LE,0,) N=N-2
 245 CONTINUE
     IF(A) 226,206,206
 250 YMIN=K*FRANG
     YMAX=(K+5)*FRANG
     YSCAL=50,/(YMAX-YMIN)
     IXMIN=XMIN
     XMIN=IXMIN
     XINT=(XMAX-XMIN)/10,
     IF(XINT-2,)252,258,254
 252 IXINT=XINT*2,+1,
     XINT=IXINT
     XINT=XINT/2,
     GO TO 258
 254 IXINT=XINT+1,
     XINT=IXINT
 258 XMAX=XMIN+10,*XINT
     XXMN = XMAX - XMIN
     XSCAL = 100,0
     IF(XXMN,GT,1,0E-40) XSCAL = 100,0 / XXMN
     YINT=(YMAX-YMIN)/5,
     XLAB(1) =XMIN
     DO 260 N=1,10
     XLAB(N+1)=XLAB(N)+XINT
     IF(XLAB(N+1),GT,24,0,AND,ICC,NE,2)XLAB(N+1)=XLAB(N+1)-24,0
 260 CONTINUE
     YLAB(6)=YMIN
     DO 270 N=1,5
 270 YLAB(6-N)=YLAB(7-N)+YINT
     CALL PPLOT(0,0,100,NPLOT)
     K = 1
     DO 450 L=1,NCV
      IF(NPT(L),EQ,0) GO TO 440
     XO=XSCAL*(X(1,L)-XMIN)
     YO=YSCAL*(Y(1,L)-YMIN)
     NPOINT = NPT(L)
     DO 400 N = 2,NPOINT
     XT = XSCAL*(X(N,L) - XMIN)
     YT = YSCAL*(Y(N,L) - YMIN)
     CALL PINE(XO,YO,XT,YT,K,NPLOT)
     XO = XT
     YO = YT
 400 CONTINUE
```

```
  420 CONTINUE
  440 K = K + 1
  450 CONTINUE
      CALL PPLOT(0,0,99,NPLOT)
      RETURN
      END
*DECK,PPLOT
      SUBROUTINE PPLOT(IX,IY,K,NCT)
C=====================================================================
      DIMENSION A(51,101),SYM(9)
      COMMON /LAB/ TITLE(18),XLAB(11),YLAB(6)
     1,HORIZ(20),VERT(7,6),IT
      DATA SYM / 4H****,4H++++, 4H'''', 4HXXXX, 4H...., 4H2222,
     1 4H    , 4HIIII, 4H---- /
      IF(K-99) 200,220,230
  200 A(51-IY,IX+1)=SYM(K)
      RETURN
  220 CONTINUE
      I=0
      WRITE(6,103) TITLE,NCT
      DO 225 II=1,6
      I=I+1
      IF(YLAB(1).LE.100000.)WRITE(6,101)YLAB(II),(A(I,J),J=1,101)
      IF(YLAB(1).GT.100000.)WRITE(6,107)YLAB(II),(A(I,J),J=1,101)
      IF(II.EQ.6) GO TO 228
      DO 224 JJ=1,9
      I=I+1
      IF(I.NE.28) GO TO 221
      WRITE(6,108) VERT(5,IT),VERT(6,IT),VERT(7,IT),(A(I,J),J=1,101)
      GO TO 224
  221 IF(I.NE.24) GO TO 222
      WRITE(6,106) VERT(1,IT),VERT(2,IT),(A(I,J),J=1,101)
      GO TO 224
  222 IF(I.NE.26) GO TO 223
      WRITE(6,106) VERT(3,IT),VERT(4,IT),(A(I,J),J=1,101)
      GO TO 224
  223 WRITE(6,100) (A(I,J),J=1,101)
  224 CONTINUE
  225 CONTINUE
  228 CONTINUE
      WRITE(6,102) XLAB
      WRITE(6,105) HORIZ
  100 FORMAT(18X,101A1)
  101 FORMAT(' ',F16.3,1X,101A1)
  102 FORMAT(' ',F19.1,10F10.1)
  103 FORMAT(1H1,20X,18A4,I6/)
  105 FORMAT(/30X,20A4)
  106 FORMAT(3X,2A4,7X,101A1)
  107 FORMAT(' ',1PE16.2,1X,101A1)
  108 FORMAT(3X,3A4,3X,101A1)
  230 DO 250 I=1,50
      DO 240 J=1,101
  240 A(I,J)=SYM(7)
      A(I,1)=SYM(8)
  250 CONTINUE
      DO 260 J=1,101
  260 A(51,J)=SYM(9)
      DO 270  I=1,101,10
  270 A(51,I)=SYM(8)
      DO 290 I=11,41,10
      A(I,1)=SYM(9)
  290 CONTINUE
      RETURN
      END
*DECK,PINE
      SUBROUTINE PINE(X1,Y1,X2,Y2,NSYM,NCT)
```

```
C=======================================================================
      AXA=X1
      AXB=X2
      AYA=Y1
      AYB=Y2
      N=1
      IF(ABS(AXB-AXA).LT.ABS(AYB-AYA)) GO TO 290
C
C     SET PARAMETERS FOR X DIRECTION
C
      IF(AXB-AXA) 241,400,245
  241 CONTINUE
      AXA=X2
      AXB=X1
      AYA=Y2
      AYB=Y1
  245 CONTINUE
      IXA=AXA+.5
      IXB=AXB+.5
      IYA=AYA+.5
      IYB=AYB+.5
  250 CONTINUE
      IF(IXA.LT.0.OR.IXA.GT.100) GO TO 260
      IF(IYA.LT.0.OR.IYA.GT.50) GO TO 260
      CALL PPLOT(IXA,IYA,NSYM,NCT)
  260 CONTINUE
      IXA=IXA+1
      XNN = N
      YA=(XNN*(AYB-AYA))/(AXB-AXA)
      IYA=AYA+YA+0.5
      N=N+1
      IF(IXA.LE.IXB) GO TO 250
      GO TO 400
C
C     SET PARAMETERS FOR Y DIRECTION
C
  290 CONTINUE
      IF(AYB.GT.AYA)   GO TO 295
      AYB=Y1
      AYA=Y2
      AXB=X1
      AXA=X2
  295 CONTINUE
      IXA=AXA+.5
      IXB=AXB+.5
      IYA=AYA+.5
      IYB=AYB+.5
  300 CONTINUE
      IF(IXA.LT.0.OR.IXA.GT.100) GO TO 310
      IF(IYA.LT.0.OR.IYA.GT.50) GO TO 310
      CALL PPLOT(IXA,IYA,NSYM,NCT)
  310 CONTINUE
      IYA=IYA+1
      XNN = N
      XA=(XNN*(AXB-AXA))/(AYB-AYA)
      IXA=XA+AXA+0.5
      N=N+1
      IF(IYA-IYB) 300,320,400
  320 IXA = IXB
      GO TO 300
  400 RETURN
      END
*DECK,OVLY-2
      OVERLAY(RUN,5,0)
*DECK,COMBIN
      PROGRAM COMBIN
```

```
C     SUBROUTINE COMBIN
      DIMENSION DUMMY(40),TITLE(40),NDATAS(16),JUNCT1(160),JUNCT2(160),
     1JUNCT3(160),QO1(160),QO2(160),QO3(160),POLL1(6,160),POLL2(6,160),
     2POLL3(6,160),JN(160,16),NOUTS(16),CPOLL(6)
      COMMON /TAPES/ INCNT,IOUTCT,JIN(10),JOUT(10),NSCRAT(5)
C
C          UPDATED  AUGUST  1974 (PRGM, W, ALAN PELTZ)
C
C          THIS PROGRAM HAS TWO MAIN OBJECTIVES, ONE COMBINES
C          DIFFERENT DATA-SETS INTO ONE WITH ONE OUTPUT NODE AND THE
C          OTHER PROGRAM COLLATES DIFFERENT DATA-SETS INTO ONE DATA-SET
C
C               ICOMB  =" IF = 1,JUST COLLATE PROGRAM IS USED
C                         IF = 2,COLLATE PROGRAM THEN COMBINE PROGRAM
C                         IF = 3,JUST COMBINE PROGRAM IS USED
C                         IF = 4,COMBINE PROGRAM THEN COLLATE PROGRAM
C
C
      WRITE(6,1)
    1 FORMAT(//,T11,'ENTRY MADE TO COMBINE MODEL', ,//,T11,'COMBINE MODE
     1L UPDATED BY UNIVERSITY OF FLORIDA AUGUST 1974',////)
C
C
      READ(5,2)ICOMB
    2 FORMAT(I5)
      IF(ICOMB,GT,2)GO TO 400
C
C          THIS PROGRAM COLLATES FROM TWO TO SIXTEEN OUTPUT DATA-SETS
C          FROM THE STORM WATER MANAGEMENT MODEL INTO ONE DATA-SET
C          AND USES TWO SCRATCH DATA-SETS,
C
C               NDOUT  =" OUTPUT DATA-SET NUMBER
C               NDATAS =" INPUT DATA-SET NUMBERS
C               NSCRT1 =" SCRATCH DATA-SET
C               NSCRT2 =" SCRATCH DATA-SET
C               NIN    =" NUMBER OF INPUT DATA-SETS
C               IGRAPH =" IF = 1, PROGRAM WILL GRAPH OUTPUT DATA-SET
C
    5 READ(5,10) TITLE
   10 FORMAT(20A4)
      READ(5,20) NDOUT,NIN,IGRAPH,(NDATAS(I),I=1,NIN)
   20 FORMAT(3I5,/,16I5)
      WRITE(6,22) TITLE
   22 FORMAT(1H1,4X,20A4,/,5X,20A4)
      WRITE(6,23)NDOUT,NIN,(NDATAS(I),I=1,NIN)
   23 FORMAT(///,10X,'OUTPUT DATA-SET UNIT NUMBER IS',I3,//,10X,
     1'THERE ARE',I2,' DATA-SETS TO BE COMBINED',/,15X,
     2'DATA-SET UNIT NUMBERS ARE',16I5)
      NSCRT1=NSCRAT(1)
      NSCRT2=NSCRAT(2)
      NTAPE=NSCRT1
      NTAPE1=NDATAS(1)
      DO 300 I=2,NIN
      NTAPE2=NDATAS(I)
      IF(I.EQ,NIN)NTAPE=NDOUT
      REWIND NTAPE
      REWIND NTAPE1
      REWIND NTAPE2
   25 READ(NTAPE1) (DUMMY(J),J=1,40)
      READ(NTAPE2) (DUMMY(J),J=1,40)
      READ(NTAPE1) NDT,NOUTS1,NPOLL,DT,TZERO,TRIBA1
      READ(NTAPE2) NDT,NOUTS2,NPOLL,DT,TZERO,TRIBA2
      TRIBA=TRIBA1+TRIBA2
      READ(NTAPE1) (JUNCT1(J),J=1,NOUTS1)
      READ(NTAPE2) (JUNCT2(J),J=1,NOUTS2)
      II=1
      JJ1=1
      JJ2=1
      J1=JUNCT1(1)
      J2=JUNCT2(1)
   55 IF(J1-J2)60,65,70
   60 JUNCT3(II)=JUNCT1(JJ1)
      JJ1=JJ1+1
      II=II+1
      IF(JJ1,GT,NOUTS1)GO TO 75
      J1=JUNCT1(JJ1)
      GO TO 55
   65 JUNCT3(II)=JUNCT1(JJ1)
      JJ1=JJ1+1
      JJ2=JJ2+1
      II=II+1
      IF(JJ1,GT,NOUTS1,AND,JJ2,GT,NOUTS2)GO TO 89
      IF(JJ1,GT,NOUTS1)GO TO 75
      IF(JJ2,GT,NOUTS2)GO TO 85
      J1=JUNCT1(JJ1)
      J2=JUNCT2(JJ2)
      GO TO 55
   70 JUNCT3(II)=JUNCT2(JJ2)
      JJ2=JJ2+1
      II=II+1
      IF(JJ2,GT,NOUTS2)GO TO 85
      J2=JUNCT2(JJ2)
      GO TO 55
75    DO 78 J2=JJ2,NOUTS2
      JUNCT3(II)=JUNCT2(J2)
   78 II=II+1
      GO TO 89
   85 DO 88 J1=JJ1,NOUTS1
      JUNCT3(II)=JUNCT1(J1)
   88 II=II+1
   89 NEWOUT=II-1
      WRITE(NTAPE) (TITLE(J),J=1,40)
      WRITE(NTAPE) NDT,NEWOUT,NPOLL,DT,TZERO,TRIBA
      WRITE(NTAPE) (JUNCT3(J),J=1,NEWOUT)
      DO 200 L=1,NDT
      READ(NTAPE1)TIME,(QO1(J),J=1,NOUTS1),((POLL1(KK,J),KK=1,NPOLL),
     1J=1,NOUTS1)
      READ(NTAPE2)TIME,(QO2(J),J=1,NOUTS2),((POLL2(KK,J),KK=1,NPOLL),
     1J=1,NOUTS2)
      II=1
      JJ1=1
      JJ2=1
      J1=JUNCT1(1)
      J2=JUNCT2(1)
  100 IF(J1-J2)110,120,130
  110 QO3(II)=QO1(JJ1)
      DO 115 JK=1,NPOLL
  115 POLL3(JK,II)=POLL1(JK,JJ1)
      JJ1=JJ1+1
      II=II+1
      IF(JJ1,GT,NOUTS1)GO TO 140
      J1=JUNCT1(JJ1)
      GO TO 100
  120 QO3(II)=QO1(JJ1)+QO2(JJ2)
      DO 125 JK=1,NPOLL
  125 POLL3(JK,II)=POLL1(JK,JJ1)+POLL2(JK,JJ2)
      JJ1=JJ1+1
      JJ2=JJ2+1
      II=II+1
      IF(JJ1,GT,NOUTS1,AND,JJ2,GT,NOUTS2)GO TO 160
      IF(JJ1,GT,NOUTS1)GO TO 140
      IF(JJ2,GT,NOUTS2)GO TO 150
      J1=JUNCT1(JJ1)
      J2=JUNCT2(JJ2)
      GO TO 100
  130 QO3(II)=QO2(JJ2)
      DO 135 JK=1,NPOLL
  135 POLL3(JK,II)=POLL2(JK,JJ2)
      JJ2=JJ2+1
      II=II+1
      IF(JJ2,GT,NOUTS2)GO TO 150
      GO TO 100
  140 DO 148 J2=JJ2,NOUTS2
      QO3(II)=QO2(J2)
      DO 145 JK=1,NPOLL
  145 POLL3(JK,II)=POLL2(JK,J2)
  148 II=II+1
  150 DO 158 J1=JJ1,NOUTS1
      QO3(II)=QO1(J1)
      DO 155 JK=1,NPOLL
  155 POLL3(JK,II)=POLL1(JK,J1)
  158 II=II+1
  160 WRITE(NTAPE) TIME,(QO3(J),J=1,NEWOUT),((POLL3(KK,J),KK=1,NPOLL),
     1J=1,NEWOUT)
  200 CONTINUE
      IF(I,EQ,NIN)GO TO 300
      IF(NTAPE,EQ,NSCRT1)GO TO 250
      NTAPE=NSCRT1
      NTAPE1=NSCRT2
      GO TO 300
  250 NTAPE=NSCRT2
      NTAPE1=NSCRT1
  300 CONTINUE
      WRITE(6,310)NEWOUT,(JUNCT3(J),J=1,NEWOUT)
  310 FORMAT(/,10X,'THERE ARE',I3,' OUTPUT NODES',/,15X,'NODE NUMBERS'
C*** ORIGINAL FORMAT LEFT OUT CARRIAGE RETURN   CORRECTED BY TWS OF EH+A
C    1,' ARE',16I5,(31X,16I5))
     1,' ARE',16I5,/,(31X,16I5))
      IF(IGRAPH,EQ,1)CALL GRAPH(1)
      WRITE(6,320)
  320 FORMAT(////,5X,'RUN COMPLETE')
      IF(ICOMB,EQ,2)GO TO 400
C     RETURN
      GO TO 5000
C
C          THIS PROGRAM COMBINES FROM TWO TO SIXTEEN OUTPUT DATA-SETS
C          FROM THE STORM WATER MANAGEMENT MODEL INTO ONE DATA-SET
C          WITH ONE OUTPUT NODE,
C
C               NODEOT =" NODE NUMBER FOR OUTPUT
C               NDOUT  =" OUTPUT DATA-SET NUMBER
C               NIN    =" NUMBER OF INPUT DATA-SETS
C               NDATAS =" INPUT DATA-SET NUMBERS
C               TITLE  =" TITLE TO BE WRITTEN ON OUTPUT DATA-SET
C               IGRAPH =" IF = 1, PROGRAM WILL GRAPH ALL INPUTS + OUTPUT
C
  400 READ(5,410) TITLE
  410 FORMAT((20A4))
      READ(5,420) NODEOT,NDOUT,NIN,IGRAPH,(NDATAS(I),I=1,NIN)
  420 FORMAT(4I5,/,16I5)
      WRITE(6,424) TITLE
  424 FORMAT(1H1,4X,20A4,/,5X,20A4)
      WRITE(6,426) NODEOT,NDOUT,NIN,(NDATAS(I),I=1,NIN)
  426 FORMAT(///,10X,'OUTPUT NODE NUMBER IS',I3,//,10X,
     1'OUTPUT DATA-SET UNIT NUMBER IS',I3,//,10X,'THERE ARE',I2,
     2' DATA-SETS TO BE COMBINED'/,15X,'DATA-SET UNIT NUMBERS ARE'16I5)
      REWIND NDOUT
      IF(IGRAPH.NE.1)GO TO 429
      DO 428 I=1,NIN                                                    COMB196
      CALL GRAPH(1)                                                     COMB197
  428 CONTINUE                                                          COMB198
  429 TRIBBA=0,0                                                        COMB199
      DO 430 I=1,NIN                                                    COMB200
      NNIN=NDATAS(I)                                                    COMB201
      REWIND NNIN                                                       COMB202
      READ(NNIN) (DUMMY(J),J=1,40)                                      COMB203
      READ(NNIN) NDT,NOUTS(I),NPOLL,DT,TZERO,TRIBA                      COMB204
      TRIBBA=TRIBBA+TRIBA                                               COMB205
      K=NOUTS(I)                                                        COMB206
      READ(NNIN) (JN(N,I),N=1,K)                                        COMB207
  430 CONTINUE                                                          COMB208
      WRITE(NDOUT) (TITLE(I),I=1,40)                                    COMB209
      NNOUTS=1                                                          COMB210
      WRITE(NDOUT) NDT,NNOUTS,NPOLL,DT,TZERO,TRIBBA                     COMB211
      WRITE(NDOUT) NODEOT                                               COMB212
      DO 470 KDT=1,NDT                                                  COMB213
      QQO=0,0                                                           COMB214
      DO 440 MM=1,NPOLL                                                 COMB215
  440 CPOLL(MM)=0,0                                                     COMB216
      DO 460 J=1,NIN                                                    COMB217
      NNIN=NDATAS(J)                                                    COMB218
      K=NOUTS(J)                                                        COMB219
      READ(NNIN) TIME,(QO1(L),L=1,K),((POLL1(KK,L),KK=1,NPOLL),L=1,K)   COMB220
      DO 450 N=1,K                                                      COMB221
      QQO=QQO+QO1(N)                                                    COMB222
      DO 450 M=1,NPOLL                                                  COMB223
      CPOLL(M)=CPOLL(M)+POLL1(M,N)                                      COMB224
  450 CONTINUE                                                          COMB225
  460 CONTINUE                                                          COMB226
      WRITE(NDOUT) TIME,QQO,(CPOLL(KK),KK=1,NPOLL)                      COMB227
  470 CONTINUE                                                          COMB228
      IF(IGRAPH.EQ.1) CALL GRAPH(1)                                     COMB229
      WRITE(6,480)                                                      COMB230
  480 FORMAT(////,5X,'RUN COMPLETE')                                    COMB231
      IF(ICOMB.EQ.4)GO TO 5                                             COMB232
  500 CONTINUE                                                          COMB233
C     RETURN                                                            COMB234
 5000 CONTINUE
      END                                                               COMB235
*DECK,OVLY-3
      OVERLAY(RUN,1,0)
*DECK,RUNOFF
      PROGRAM RUNOFF
C     SUBROUTINE RUNOFF                                                 RUNO  1
C=======================================================================RUNO  2
C                                                                       RUNO  3
C         THIS IS THE NEW RUNOFF VERSION                                RUNO  4
C         THE RUNOFF BLOCK WAS LAST UPDATED FEBRUARY 1975 BY            RUNO  5
C         THE UNIVERSITY OF FLORIDA (PRG. W. ALAN PELTZ)                RUNO  6
C                                                                       RUNO  7
C         THE RUNOFF BLOCK USES ONLY ONE SCRATCH DATA-SET AND           RUNO  8
C         ONE OUTPUT DATA-SET (JOUT)                                    RUNO  9
C                                                                       RUNO 10
      COMMON/TAPES/ INCNT,IOUTCT,JIN(10),JOUT(10),NSCRAT(5)             RUNO 11
      COMMON /CDCOLY/NPRNT
C                                                                       RUNO 12
      WRITE(6,102)                                                      RUNO 13
  102 FORMAT(////,10X,'ENTRY MADE TO RUNOFF MODEL',//,T11,'RUNOFF MODEL RUNO 14
     1UPDATED BY UNIVERSITY OF FLORIDA FEBRUARY 1975',//)               RUNO 15
      INCNT=INCNT+1                                                     RUNO 16
      IOUTCT=IOUTCT+1                                                   RUNO 17
C*** CALL STATEMENTS REWRITTEN FOR CDC MACHINE OVERLAY STRUCTURE
C****  ADDED COMMON BLOCK /CDCOLY/ TO TRANSFER VALUE NPRNT,  TWS OF EH+A
C     CALL HYDRO(NPRNT)                                                 RUNO 18
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      CALL OVERLAY(3HRUN,1,1,6HRECALL)
C     IF(NPRNT,GT,0) CALL RECAP                                         RUNO 19
      IF(NPRNT,GT,0)
     *CALL OVERLAY(3HRUN,1,2,6HRECALL)
      NOUT=JOUT(IOUTCT)                                                 RUNO 20
      IF(NOUT,GT,0) REWIND NOUT                                         RUNO 21
      WRITE(6,6020)                                                     RUNO 22
 6020 FORMAT( 1H1/// 30X, ',,,,,,,,,SURFACE SIMULATION ENDED NORMALLY,,,RUNO 23
     1,,,,,,,' )                                                        RUNO 24
C     RETURN                                                            RUNO 25
      END                                                               RUNO 26
*DECK,BLKD-1
      BLOCK DATA                                                        RNBD  1
C=======================================================================RNBD  2
      COMMON/ABLK/ NQS,CLFREQ,DRYDAY,NPASS,CBVOL,                       RNBD  3
     1             C(200,20),CDOT(200,20),PSHED(200,20),POFF(200,20),   RNBD  4
     2             KLAND(200),DDFACT(5),QFACT(5,20),PBASIN(200,20),     RNBD  5
     3             BASINS(200),CBFACT(20),GQLEN(200),F1(20),F2(20)      RNBD  6
C-                                                                      RNBD  7
C-                                                                      RNBD  8
C-,,,,,NOTE ORDER OF POLLUTANT COMPUTATION,,,,,                          RNBD  9
C-      1 - SETTLEABLE SOLIDS                                           RNBD 10
C-      2 - SUSPENDED SOLIDS  (WITH EROSION IF IROS = 1)                RNBD 11
C-      3 - COLIFORMS                                                   RNBD 12
C-      4 - BOD                                                         RNBD 13
C-      5 - COD                                                         RNBD 14
C-      6 - N                                                           RNBD 15
C-      7 - PO4                                                         RNBD 16
C-      8 - GREASE                                                      RNBD 17
C-      9 - SS WITHOUT EROSION  (IF IROS = 1)                           RNBD 18
C-                                                                      RNBD 19
C-,,,,,SETUP INITIAL POLLUTION LOADINGS,,,,,                             RNBD 20
C-                 DDFACT =" LB OF POLLUTANT PER DAY PER 100 FT OF CUR  RNBD 21
C-                 QFACT  =" MG OF POLLUTANT PER GRAM DUST + DIRT       RNBD 22
C-                                                                      RNBD 23
C-,,,,,NOTE UNITS,,,,,                                                   RNBD 24
C-      DDFACT - LB/DAY/100FT CURB                                      RNBD 25
C-      QFACT - MG POLL/G D+D                                           RNBD 26
C-                                                                      RNBD 27
C-                                                                      RNBD 28
      DATA DDFACT/0,7,2,3,3,3,4,6,1,5/                                  RNBD 29
      DATA QFACT/100,,100,,100,,100,,100,,1000,,1000,,1000,,1000,,1000,,RNBD 30
     1 1,3E+6,2,7E+6,1,7E+6,1,E+6,0,,   5,0,3,6,7,7,3,0,5,0,            RNBD 31
     2             40,,40,,39,,40,,20,,   ,48,,61,,41,,43,,05,          RNBD 32
     3             ,05,,05,,07,,03,,01,   1,0,1,0,1,0,1,0,1,0,          RNBD 33
     4             60*0,0/                                              RNBD 34
      DATA F1/   0,0,0,0,0,0,,02,0,0,,01,,001,  13*0,0/                 RNBD 35
      DATA F2/   0,0,0,0,0,0,,05,0,0,,045,,0045,  13*0,0/               RNBD 36
      DATA CBFACT/0,0,0,0,0,0,100,0, 16*0,0/                            RNBD 37
      DATA C,CDOT/8000*0,0/                                             RNBD 38
      END                                                               RNBD 39
*DECK,GQUAL
      SUBROUTINE GQUAL(J,AREA0,AREA1,FLOW0,VSURO)                       GQUA  1
C=======================================================================GQUA  2
C-                                                                      GQUA  3
C-,,,,,THIS SUBROUTINE ROUTES QUALITY IN GUTTER J FOR THE FLOW VALUES   GQUA  4
C-      COMPUTED IN SUBROUTINE GUTTER ,,  NQS QUALITIES ARE CALCULATED,,,GQUA  5
C-                                                                      GQUA  6
      COMMON/ABLK/ NQS,CLFREQ,DRYDAY,NPASS,CBVOL,                       GQUA  7
     1             C(200,20),CDOT(200,20),PSHED(200,20),POFF(200,20),   GQUA  8
     2             KLAND(200),DDFACT(5),QFACT(5,20),PBASIN(200,20),     GQUA  9
     3             BASINS(200),CBFACT(20),GQLEN(200),F1(20),F2(20),     GQUA 10
     4             TFLOW,TBOD,TSUS,TCOL,CVSUR(200,20)                   GQUA 11
      COMMON /TAPES/ INCNT,IOUTCT,JIN(10),JOUT(10),NSCRAT(5)            GQUA 12
      COMMON NW,NG,NIN,HISTOG,TRAIN,DELT,DELT2,NOW,NOG,NSTEP,TARFA,     GQUA 13
     1 TIME,TIME2,RI,RLOSS,SUMR,SUMI,SUMOFF,SUMST,TZERO,NING            GQUA 14
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```
       COMMON WFLOW(200),WWIDTH(200),WAREA(200),WSLOPE(200),WN(200),
      1 WSTORE(200,3),WLMAX (200),WLMIN(200),DECAY(200),WDEPTH(200,3),
      2 WCON(200,3),NAMEW(200),PCIMP(200)
       COMMON GFLOW(200),GWIDTH(200),GLEN(200),GSLOPE(200),GS1(200),
      1 GS2(200),GN(200),GDEPTH(200),GCON(200),NPG(200),DFULL(200),
      2 NGUT(200),SUMQW(200),PCTZER
       COMMON NWTOG(200,10),NGTOG(200,10),NWTOI(10),NGTOI(200)
       COMMON RAIN(200,10),NHYET(200),NRAIN,NRGAG,NHISTO,THISTO
       COMMON QSUR(200),DELD(200),QIN(200)
       COMMON IPRNT(200),ISAVE(200),NPRNT,NSAVE,OUTFLW(200),INTERV,
      1 INTCNT
       COMMON /ERSON/ ERROSN(200),EROSN,ERLFN(200),CONTPF(200),CROPMF(200
      1),SOILF(200),ERODAR(200),IROS,RAINIT,CNSTNT(200),ISS
       DIMENSION FLUX(20)
C-
C-
C-,,,,,CHECK FLOW AND SET ZEROS IF BELOW MINIMUM,,,,,
C-
      NNQS=NQS
      IF(IROS.EQ,1) NNQS = NQS + 1
      IF( GFLOW(J) ,GT, 0,005 ) GO TO 150
      DO 130 K = 1,NNQS
      C(J,K) = CDOT(J,K) * 0,5
      CDOT(J,K) = 0,0
  130 CONTINUE
      RETURN
C-
  150 CONTINUE
C-
C-,,,,,COMPUTE INPUTS FROM UPSTREAM GUTTERS,,,,,
C-.....INPUTS ARE AVERAGE OVER TIME STEP,
C-
      ALFA = 2,0/DELT
      DO 200 K = 1,NNQS
      FLUX(K) = 0,0
  200 CONTINUE
      DO 240 K = 1, NIN
      L = NGTOG(J,K)
      IF( L ,EQ, 0 ) GO TO 245
      DO 220 M = 1,NNQS
      FLUX(M) = FLUX(M) + C(L,M) * GFLOW(L)
  220 CONTINUE
  240 CONTINUE
  245 CONTINUE
C-
C-.....ADD MASS INPUT FROM ADJACENT WATERSHEDS,,POFF IN MG/SEC,,,,,
C-,,,,.POFF IS AVERAGE OVER THE TIME STEP,
C-
      DO 280 K = 1, NIN
      L = NWTOG(J,K)
      IF( L ,EQ, 0 ) GO TO 285
      DO 260 M = 1,NNQS
      FLUX(M) = FLUX(M) + POFF(L,M)/28,317
  260 CONTINUE
  280 CONTINUE
  285 CONTINUE
C-
C-,,,,,COMPUTE CONCENTRATIONS FOR DUMMY GUTTERS,
C-
      IF(NPG(J),NE,3) GO TO 300
      DO 290 M = 1,NNQS
  290 C(J,M) = FLUX(M) / QIN(J)
C-
      RETURN
C-
C-.....ACCOUNT FOR SURCHARGE CONTRIBUTION
```

```
C-
  300 IF(QSUR(J).LE.0.0.AND.VSURO.LE.0.0) GO TO 360
      QADD = (VSURO - QSUR(J)) / DELT
C-
C-.....COMPUTE ACTUAL INFLOW
C-
      QACT = QTN(J) + QADD
      DO 350 M = 1,NNQS
C-
C-.....ADD TO MG/L * CU FT STORED IN SURCHARGE.
C-
      IF(QADD.LT.0.0) CVSUR(J,M) = CVSUR(J,M) - QADD * DELT * FLUX(M)
     1 / QIN(J)
C-
C-.....COMPUTE TOTAL POTENTIAL FLUX IN.
C-
      FLUX(M) = FLUX(M) + CVSUR(J,M) / DELT
C-
C-.....COMPUTE ACTUAL FLUX IN.
C-
      FLUX(M) = FLUX(M) * QACT / (QIN(J) + QSUR(J) / DELT)
C-
C-.....SUBTRACT FROM MG/L * CU FT STORED IN SURCHARGE
C-
      IF(QADD.GT.0.0) CVSUR(J,M) = CVSUR(J,M) - QADD * DELT * CVSUR(J,M)
     1 / VSURO
  350 IF(CVSUR(J,M).LT.0.0) CVSUR(J,M) = 0.0
  360 CONTINUE
C-
C-.....COMPUT CURRENT VALUES OF GUTTER PARAMETERS FOR ROUTING.....
C-
      V0 = GLEN(J) * AREA0
      V1 = GLEN(J) * AREA1
      VQ = ALFA * V0 - FLOW0
      TEMP = 0.0
      TEST = ALFA * V1 + OUTFLW(J)
      IF(TEST.GT.1.0E-15) TEMP = 1.0 / TEST
C-
C-.....COMPUTE FINAL PARAMETERS.
C-.....ROUTING ASSUMES COMPLETE MIXING WITHIN GUTTER/PIPE.
C-.....C(J,M) = FLOW - AVERAGED OUTFLOW CONCENTRATION
C-.....(AND MIXED CONCENTRATION) OVER TIME STEP.
C-.....CDOT(J,M) = CONCENTRATION AT BEGINNING OF TIME STEP.
C-
      DO 400 M = 1,NNQS
      CC = CDOT(J,M)
C-
C-.....DEFINE CDOT(J,M) FOR NEXT TIME STEP.
C-
      CDOT(J,M) = TEMP * (CC * VQ + 2.0 * FLUX(M))
C-
C-.....COMPUTE FLOW-WEIGHTED CONCENTRATION.
C-
  400 C(J,M) = (FLOW0 * CC + OUTFLW(J) * CDOT(J,M)) / (2.0 * GFLOW(J))
C-
      RETURN
      END
*DECK,GUTTER
      SUBROUTINE GUTTER
C=======================================================================
C
C     THIS SUBROUTINE COMPUTES THE INSTANTANEOUS WATER DEPTH
C          AND FLOW RATE FOR THE GUTTERS/PIPES
C
C************** SPECIFICATION STATEMENTS
C
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```
      COMMON /TAPES/ INCNT,IOUTCT,JIN(10),JOUT(10),NSCRAT(5)
      COMMON NW,NG,NIN,HISTOG,TRAIN,DELT,DELT2,NOW,NOG,NSTEP,TAREA,
     1 TIME,TIME2,PI,RLOSS,SUMR,SUMI,SUMOFF,SUMST,TZERO,NING
      COMMON WFLOW(200),WWIDTH(200),WAREA(200),WSLOPE(200),WN(200),
     1 WSTORE(200,3),WLMAX (200),WLMIN(200),DECAY(200),WDEPTH(200,3),
     2 WCON(200,3),NAMEW(200),PCIMP(200)
      COMMON GFLOW(200),GWTDTH(200),GLEN(200),GSLOPE(200),GS1(200),
     1 GS2(200),GN(200),GDEPTH(200),GCON(200),NPG(200),DFULL(200),
     2 NGUT(200),SUMQW(200),PCTZER
      COMMON NWTOG(200,10),NGTOG(200,10),NWTOI(10),NGTOI(200)
      COMMON RAIN(200,10),NHYET(200),NRAIN,NRGAG,NHISTO,THISTO
      COMMON QSUR(200),DFLD(200),QIN(200)
      COMMON IPRNT(200),ISAVE(200),NPRNT,NSAVE,OUTFLW(200),INTERV,
     1 INTCNT
      COMMON/ABLK/ NQS,CLFREQ,DRYDAY,NPASS,CBVOL,
     1             C(200,20),CDOT(200,20),PSHED(200,20),POFF(200,20),
     2             KLAND(200),DDFACT(5),QFACT(5,20),PBASIN(200,20),
     3             BASINS(200),CBFACT(20),GQLEN(200),F1(20),F2(20),
     4             TFLOW,TBOD,TSUS,TCOL,CVSUR(200,20)
      COMMON /ERSON/ ERROSN(200),EROSN,ERLEN(200),CONTPF(200),CROPMF(200
     1),SOILF(200),ERODAR(200),IROS,RAINIT,CNSTNT(200),ISS
      DIMENSION WFAVE(200)
C
C********* DEFINITIONS
C
C********* J - FIRST GUTTERS ROUTED ARE ACTUAL INPUT GUTTERS,
C              THEN NSAVE DUMMY GUTTERS ARE ROUTED,
C              ONE DUMMY GUTTER IS ASSIGNED TO EACH INLET,
C********* NGTOI = INTERNAL SUBSCRIPT OF A DUMMY GUTTER FEEDING AN INLET,
C********* NWTOG = INTERNAL SUBSCRIPT OF SUBCATCHMENT(S) FEEDING A GUTTER
C********* NGTOG = INTERNAL SUBSCRIPT OF GUTTER(S) FEEDING A GUTTER,
C
      INLETS=NSAVE
      NOGG=NOG+NSAVE
      IF(NOG,EQ,999) NOGG=NSAVE
      DO 410 N = 1, NOGG
      J=NGUT(N)
C
C********* INPUTS FROM ADJACENT WATERSHED AREAS
C
      SUMQW(J)=0,
      DO 220 JK=1,NIN
      IF(NWTOG(J,JK),EQ,0) GO TO 240
      NX=NWTOG(J,JK)
  220 SUMQW(J)=SUMQW(J)+WFLOW(NX)
  240 IF(TIME,EQ,TZERO+DELT) WFAVE(J) = 0,0
      QIN(J) = (SUMQW(J) + WFAVE(J))* 0,5
      WFAVE(J) = SUMQW(J)
C
C********* INPUTS FROM UPSTREAM GUTTERS
C
      DO 260 JK=1,NIN
      IF(NGTOG(J,JK),EQ,0) GO TO 280
      NX=NGTOG(J,JK)
  260 QIN(J)=QIN(J)+GFLOW(NX)
C
C********* FINAL VALUE OF QIN IS AVERAGE INFLOW OVER TIME STEP,
C
  280 DO=GDEPTH(J)
      IF(QIN(J),NE,0,) GO TO 290
      IF(GDEPTH(J).LE,0,) GO TO 391
C
C********* BYPASS ROUTING FOR DUMMY GUTTERS,
C
  290 IF(NPG(J),EQ,3) GO TO 391
      IFLG=0
      IFLAG2 = 0
      DELD(J)=0,
      VSURO = QSUR(J)
C
C******** COMPUTE CHANGE IN DEPTH (NEWTON-RAPHSON)
C
C******** D1 = ESTIMATED FINAL DEPTH
C******** FOR PIPES, 'DEPTH' IS HALF OF ANGLE SUBTENDED BY
C******** WETTED PERIMETER, IN RADIANS,
C
      DO 360 I = 1,30
      D1=GDEPTH(J)+DELD(J)
      IF(NPG(J),EQ,2) GO TO 295
C
C                 * * * * * * * * * * * * * * * * * * * * *
C
C**** TRAPEZOIDAL GUTTER
C
      IF(D1,LT,0,) D1=0,
C
C******** VOLUME CHANGE (TRAPEZOIDAL SECTION)
C
      DELV=GLEN(J)*DELD(J)*((GS1(J)+GS2(J))*(D0+0,5*DELD(J))+GWIDTH(J))
      DDELV=GLEN(J)*((GS1(J)+GS2(J))*D1+GWIDTH(J))
C
C******** CROSS-SECTIONAL AREA (TRAPEZOIDAL CROSS-SECTION)
C
      AX0=0,5*(GS1(J)+GS2(J))*D0**2+GWIDTH(J)*D0
      AX1=0,5*(GS1(J)+GS2(J))*D1**2+GWIDTH(J)*D1
      DAX1=(GS1(J)+GS2(J))*D1+GWIDTH(J)
C
C******** WETTED PERIMETER (TRAPEZOIDAL CROSS-SECTION)
C
      WP0=SQRT(GS1(J)**2+1,)*D0+SQRT(GS2(J)**2+1,)*D0+GWIDTH(J)
      WP1=SQRT(GS1(J)**2+1,)*D1+SQRT(GS2(J)**2+1,)*D1+GWIDTH(J)
      DWP1=SQRT(GS1(J)**2+1,)+SQRT(GS2(J)**2+1,)
      GO TO 315
C
C                 * * * * * * * * * * * * * * * * * * * * *
C
C**** CIRCULAR PIPE
C
  295 IF(I,GT,1) GO TO 307
      D1=1,5707963
      DELD(J)=D1-GDEPTH(J)
  307 IF(D1,GT,0,) GO TO 308
      IFLAG2 = IFLAG2 + 1
      D1=0,
      DELD(J)=-GDEPTH(J)
  308 IF(D1,LE,DFULL(J)) GO TO 310
      D1=DFULL(J)
      DELD(J)=D1-GDEPTH(J)
C
C******** VOLUME CHANGE (PIPE)
C
  310 DELV=GLEN(J)*(GWIDTH(J)**2/4,)*(DELD(J)-0.5*SIN(2,*D1)
     1 +0,5*SIN(2,*D0))
      DDELV=GLEN(J)*(GWIDTH(J)**2/4,)*(1,-COS(2,*D1))
C
C******** CROSS-SECTIONAL AREA (PIPE)
C
      AX0=(GWIDTH(J)**2/4,)*(D0-0,5*SIN(2,*D0))
      AX1=(GWIDTH(J)**2/4,)*(D1-0,5*SIN(2,*D1))
      DAX1=(GWIDTH(J)**2/4,)*(1,-COS(2,*D1))
C
C******** WETTED PERIMETER (PIPE)
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                                                                        GUTT141
C                                                                       GUTT142
      WP0=GWIDTH(J)*D0                                                  GUTT143
      WP1=GWIDTH(J)*D1                                                  GUTT144
      DWP1=GWIDTH(J)                                                    GUTT145
C                                                                       GUTT146
C                 * * * * * * * * * * * * * * * * * * * * *             GUTT147
C                                                                       GUTT148
C********* HYDRAULIC RADIUS (ALL CROSS-SECTIONS)                         GUTT149
C                                                                       GUTT150
  315 IF(AX0,LT,0,) AX0=0,                                              GUTT151
      IF(AX1,LT,0,) AX1=0,                                              GUTT152
      IF(WP0,LE,0,) WP0=0,001                                           GUTT153
      IF(WP1,LE,0,) WP1=0,001                                           GUTT154
      RAD0=AX0/WP0                                                      GUTT155
      RAD1=AX1/WP1                                                      GUTT156
C                                                                       GUTT157
C********* FLOW                                                          GUTT158
C                                                                       GUTT159
      FLOW0=GCON(J)*(AX0**1,6666667)/(WP0**0,66666667)                  GUTT160
      FLOW1=GCON(J)*(AX1**1,6666667)/(WP1**0,66666667)                  GUTT161
C                                                                       GUTT162
C********* OUTFLW = INSTANTANEOUS FLOW AT END OF TIME STEP,              GUTT163
C                                                                       GUTT164
      OUTFLW(J) = FLOW1                                                 GUTT165
      FLOW=0,5*(FLOW0+FLOW1)                                            GUTT166
      DFLOW1=0,5*GCON(J)*(1,6666667*(RAD1**0,66666667)*DAX1             GUTT167
     1 -0,66666667*(RAD1**1,6666667)*DWP1)                              GUTT168
C                                                                       GUTT169
C********* NEWTON-RAPHSON CORRECTION (ALL CROSS-SECTIONS)                GUTT170
C                                                                       GUTT171
      F=DELV+DELT*(FLOW-QIN(J))-QSUR(J)                                 GUTT172
      DF=DDELV+DELT*DFLOW1                                              GUTT173
      IF(DF,GT,1,0E-10)GO TO 320                                        GUTT174
C                                                                       GUTT175
C********* ZERO SLOPE                                                    GUTT176
C                                                                       GUTT177
      DEL=0,01                                                          GUTT178
      GO TO 340                                                         GUTT179
C                                                                       GUTT180
C********* NON-ZERO SLOPE                                                GUTT181
C                                                                       GUTT182
  320 DEL=DELD(J)-F/DF                                                  GUTT183
C                                                                       GUTT184
C********* CONVERGENCE CHECK (INDIVIDUAL GUTTER)                         GUTT185
C                                                                       GUTT186
  340 CONTINUE                                                          GUTT187
      IF(GDEPTH(J)+DEL,LT,DFULL(J)) GO TO 355                           GUTT188
      IF(IFLG,EQ,1) GO TO 390                                           GUTT189
      DEL=DFULL(J)-GDEPTH(J)                                            GUTT190
      IFLG=1                                                            GUTT191
      GO TO 360                                                         GUTT192
C                                                                       GUTT193
C********* CONVERGENCE REQUIRES ABS(I-O-DELTA S) ,LT, 0,1 CU FT,         GUTT194
C                                                                       GUTT195
  355 IFLG=0                                                            GUTT196
      IF(ABS(F),LT,0,1) GO TO 380                                       GUTT197
      IF(IFLAG2,GE,2) GO TO 370                                         GUTT198
  360 DELD(J)=DEL                                                       GUTT199
C                                                                       GUTT200
C********* NO CONVERGENCE, DEFAULT TO VALUES AT LAST TIME STEP,          GUTT201
C                                                                       GUTT202
      WRITE(6,1000) TIME,J,GDEPTH(J),DELD(J),FLOW0,QIN(J),F             GUTT203
 1000 FORMAT(' CHECK RESULTS,  NOT CONVERGED IN *GUTTER*',              GUTT204
     1/,T5,'TIME =',F8,0,T20,'J =',I3,T30, 'GDEPTH =',F8,3,T45,'DELD =',GUTT205
     2F9,3,T60,'FLOW0 =', F10,4,T78,'QIN =',F10,4,T95,'F =',F10,4)      GUTT206
      DEL=0.0
      FLOW = FLOWO
      OUTFLW(J) = FLOWO
      GO TO 380
C
C******** NO CONVERGENCE DUE TO ATTEMT TO GIVE NEGATIVE FLOW + VOLUME,
C******** AS DEFAULT, USE ZERO VALUES.
C
  370 WRITE(6,1010)TIME,J,GDEPTH(J),FLOWO,QIN(J),F
 1010 FORMAT (' CAUTION, DEFAULT TO ZERO IN GUTTER, TIME=',F8.1,' J=',
     1 I3,' GDEPTH=',F8.4,' FLOWO=',F8.3,' QIN=',F8.3,' CONTINUITY ERROR
     2=',F8.2,' CU FT')
      DEL = -GDEPTH(J)
C
C
C******** NEW DEPTH AT END OF TIME INTERVAL
C
  380 DELD(J)=DEL
      GDEPTH(J)=GDEPTH(J)+DELD(J)
      QSUR(J)=0.
C
C******** AVERAGE FLOW DURING TIME INTERVAL
C
      IF(FLOW.LT.1.0E-10) FLOW=0.0
      GFLOW(J)=FLOW
      GO TO 400
C
C******** SURCHARGE
C
  390 GDEPTH(J)=DFULL(J)
      GFLOW(J)=FLOW1
      QSUR(J)=QSUR(J)+(QIN(J)-FLOW)*DELT
      IF(QSUR(J).LT.0.) QSUR(J)=0.
      GO TO 400
  391 GFLOW(J)=QIN(J)
      VSURO = 0.0
  400 IF( NQS .GT. 0 )  CALL GQUAL(J, XO,AX1,FLOWO,VSURO)
  410 CONTINUE
C
C******** PRINT SELECTED OUTPUT
C
      IF(NPRNT.LT.1) GO TO 510
      INTCNT=INTCNT+1
      IF(INTCNT.LT.INTERV) GO TO 510
      INTCNT=0
      DO 500 N=1,NPRNT
      J=IPRNT(N)
  500 OUTFLW(N)=QIN(J)
      NTIMEH=TIME/3600.
      TIMEM=TIME/60.-FLOAT(NTIMEH)*60.
      NSCRT1 = NSCRAT(1)
      WRITE(NSCRT1) NTIMEH,TIMEM,(OUTFLW(N),N=1,NPRNT)
      IF( NQS .LT. 1 ) GO TO 504
      NNQS=NQS
      IF(IROS.EQ.1) NNQS = NQS + 1
      DO 503 J = 1, NPRNT
      N = IPRNT(J)
      DO 502 K = 1,NNQS
      POFF(J,K) = C(N,K)
  502 CONTINUE
  503 CONTINUE
      WRITE(NSCRT1) NTIMEH,TIMEM,(POFF(J,4),POFF(J,2),POFF(J,3),POFF(J,5
     1),POFF(J,1),(POFF(J,K),K=6,NNQS),J=1,NPRNT)
  504 CONTINUE
      IF(NOG.EQ.999)GO TO 510
      DO 505 N=1,NOG
      J=NGUT(N)
      IF(QSUR(J),GT,0) WRITE(6,9000) J,QSUR(J),GFLOW(J),TIME            GUTT273
 9000 FORMAT (' GUTTER',I4,' SURCHARGED, SURCHARGE =',F10,0,' CU FT, FLOGUTT274
  505 CONTINUE                                                          GUTT276
     1W =',F10.1,' CFS, TIME ',F10.1,' SEC.')                           GUTT275
  505 CONTINUE                                                          GUTT276
C                                                                       GUTT277
C******** WRITE INLETS TO BE SAVED                                      GUTT278
C                                                                       GUTT279
  510 NOUT(JOUT(IOUTCT)                                                 GUTT280
      IF( NOUT ,LT, 1 ) GO TO 670                                       GUTT281
      DO 640 N = 1, INLETS                                              GUTT282
      J = NGTOI(N)                                                      GUTT283
      OUTFLW(N) = QIN(J)                                                GUTT284
C                                                                       GUTT285
C******** AT PRESENT ONLY THREE POLLUTANTS ARE SAVED BOD,SUS-S,COLIF    GUTT286
C******** THE OTHER BLOCKS WILL ONLY TAKE THESE THREE POLLUTANTS        GUTT287
C                                                                       GUTT288
      IF(NQS,EQ,0) GO TO 636                                            GUTT289
C                                                                       GUTT290
C******** POFF(N,2)=SUS-S, POFF(N,3)=COL, POFF(N,4)=BOD                 GUTT291
C                                                                       GUTT292
      POFF(N,2) = C(J,2)*QIN(J)*6,24286E-5*60,0                         GUTT293
      POFF(N,3) = C(J,3)*QIN(J)*28,3*60,0                               GUTT294
      POFF(N,4) = C(J,4)*QIN(J)*6,24286E-5*60,0                         GUTT295
  636 IF(NQS,EQ,0) POFF(N,4)=0,0                                        GUTT296
      TFLOW = TFLOW + OUTFLW(N) * DELT                                  GUTT297
      TBOD = TBOD + POFF(N,4) * DELT / 60,0                             GUTT298
      TSUS = TSUS + POFF(N,2) * DELT / 60,0                             GUTT299
      TCOL = TCOL + POFF(N,3) * DELT / 60,0                             GUTT300
  640 CONTINUE                                                          GUTT301
      IF(NQS,GT,0) WRITE(NOUT) TIME,(OUTFLW(N),N=1,INLETS),(POFF(J,4),  GUTT302
     1POFF(J,2),POFF(J,3),J=1,INLETS)                                   GUTT303
      IF(NQS,EQ,0) WRITE(NOUT) TIME,(OUTFLW(N),N=1,INLETS),(POFF(J,4),  GUTT304
     1  J=1,INLETS)                                                     GUTT305
  670 CONTINUE                                                          GUTT306
C                                                                       GUTT307
      RETURN                                                            GUTT308
      END                                                               GUTT309
*DECK,TRANS
      PROGRAM TRANS
C     SUBROUTINE TRANS                                                  TRAN   1
C=======================================================================TRAN   2
C                                                                       TRAN   3
C*************** UNIVERSITY OF FLORIDA TRANSPORT MODEL***************** TRAN   4
C                UPDATED FEBRUARY 1975 (PRG. W. ALAN PELTZ)             TRAN   5
C                                                                       TRAN   6
C*********SPECIFICATION STATEMENTS                                      TRAN   7
C                                                                       TRAN   8
      DIMENSION QI(160),QO(160),SURGE1(160),SURGE2(160),WELL1(160),     TRAN   9
     1 WELL2(160),PUMP(160),       QO1(160),QO2(160),OUTIN(10,5),       TRAN  10
     2 OUT(10,5),OUTTAP(50,5)                                           TRAN  11
      COMMON /TAPES/ INCNT,IOUTCT,JIN(10),JOUT(10),NSCRAT(5)            TRAN  12
      COMMON/DRWF/ DVDWF(7),DVBOD(7),DVSS(7),HVDWF(24),HVBOD(24),       TRAN  13
     1              HVSS(24),HVCOLI(24),KTNUM,KDAY,KHOUR,KMINS          TRAN  14
      COMMON/TABLES/ KDEPTH(35),KLASS(35),PSIMAX(25),ALFMAX(25),NN(35),
     1               MH(35),ANORM(25,51),QNORM(25,51),DNORM(25,51),
     2   AFACT(25),  RFACT(25)
      COMMON /NAMES/ NAME(4,35),GNO,YES,BLANK
C****    NEXT CARD ADDED BY TS OF EH%A ON  1/25/76         *************
      COMMON /NVALUE/ RUF(10)
      COMMON A(160,2,2),Q(160,2,2),CPOL1(160,2,5),CPOL2(160,2,5),QMAX(16TRAN  19
     10),    QFULL(160), AFULL(160), DXDT(160),C1(160), SLOPE(160),     TRAN  20
     2       DIST(160), GEOM1(160), ROUGH(160), NOE(160), NUE(160,3),   TRAN  21
     3       INUE(160,3), NTYPE(160), JR(160), NKLASS, NE, NDT, EPSIL,  TRAN  22
     4       TIME, DT, M, KFULL, N, NOS, NPOLL, NPRINT, ITER,           TRAN  23
     5       QDWF(160), IOLD(160), P1(160), RNOFF(160), QINFIL(160),    TRAN  24
     6       WDWF(160,5), PLUTO(160,5), IR(160), P2(160), NIN(1000),
     7       P5(160),P6(160),P7(160),SCF(160),BARREL(160),
     8       TITLE(40), NPE(20), NYN(20), NORDER(70), GEOM2(160),
     9       GEOM3(160) , P4(160),SCOUR(160), KSTORE(160)
      COMMON  BODIN( 2,150),SSIN( 2,150),BODOUT,SSOUT,COLIN(2,150),
     *  QINST,QOUST,QINSTL( 2),QOUSTL( 2),STORL( 2),QOUTO( 2),STORO( 2),
     *  NSTOR,KSTOR,IPRINT( 2),IPOL( 2),IFLOOD( 2),ICOST( 2),DEPMAX( 2),
     *  ATERM( 2,11),AO2DT2( 2,11),BDEPTH( 2,11),BSTOR( 2,11),COLOUT,
     *  DUMSTR(11),DUMDEP(11),
     *  KTSTEP,VOLIN( 2,150),VOLOUT( 2,150),STOR,CUMIN( 2),CUMOUT( 2),
     *  SBOD( 2),SSS( 2),SCOL( 2),
     *  ISTMOD( 2),ISTTYP( 2),ISTOUT( 2),
     *  QPUMP( 2),DSTART( 2),DSTOP( 2),
     *  DTON( 2),STORMX( 2),DTPUMP( 2),DTMORE( 2),STORF( 2),APLAN( 2),
     *  CLAND( 2),CSTOR( 2),CPS( 2),CTOTAL( 2),CPCUYD( 2),CPACRE( 2),
     *  LP,JP,LPREV( 2),LABEL,DETENT(150),FRAC(150),OUT1(10,200)
      EQUIVALENCE (QO(1),Q(1,2,2)),(QI(1),Q(1,1,2))
      EQUIVALENCE (PUMP(1),DIST(1)),(SURGE1(1),P1(1)),(SURGE2(1),P2(1))
      EQUIVALENCE (QO1(1),QMAX(1)),(QO2(1),QFULL(1))
      EQUIVALENCE (WELL1(1),SLOPE(1)),(WELL2(1),ROUGH(1))
      DIMENSION JN(5),RANK(160,5)
      DATA ASTER/1H*/
C
C
      WRITE(6,10)
   10 FORMAT(//,T11,'ENTRY MADE TO TRANSPORT MODEL',//,T11,'TRANSPORT MO
     1DEL UPDATED BY UNIVERSITY OF FLORIDA FEBRUARY 1975',////)
C
C
C********READ DATA DESCRIBING USER SUPPLIED CONDUITS, IF ANY,
C
      READ(5,901)NKLASS,KPRINT,NCHANL
  901 FORMAT(16I5)
      NKLAS=NKLASS +13
      IF (NKLASS,LE,0)  GO TO 41
      READ (5,903) ((NAME(J,I),J=1,4),I=14,NKLAS)
  903 FORMAT(20A4)
      READ (5,901) (NN(I),I=14,NKLAS)
      READ (5,901) (MM(I),I=14,NKLAS)
      READ (5,900) (ALFMAX(I),I=14,NKLAS)
      READ (5,900) (PSIMAX(I),I=14,NKLAS)
  900 FORMAT(8F10,0)
      READ (5,900) (AFACT(I),I=14,NKLAS)
      READ (5,900) (RFACT(I),I=14,NKLAS)
C     READ PARAMENTERS FOR DEPTH-AREA RELATIONSHIPS,
      DO 18 I=14,NKLAS
      KDEPTH(I) = 2
      NNN = NN(I)
      READ (5,900) (DNORM(I,J),J=1,NNN)
      NNN = NNN+1
      IF (NNN,GT,51) GO TO 18
      DO 17 J=NNN,51
   17 DNORM(I,J)=0,0
   18 CONTINUE
C     READ PARAMETERS AND PERFORM INITIALIZING CALCULATIONS ON Q-A CURVE
      DO 40 I=14,NKLAS
      KLASS(I) = 2
C     CONDUIT WITH TABULAR Q-A RELATIONSHIP
      MMM = MM(I)
      READ(5,900)(QNORM(I,J),J=1,MMM)
      DALPHA=1,0/FLOAT(MMM-1)
      ANORM(1,1)=0,0
      DO 33 J=2,MMM
   33 ANORM(I,J)=ANORM(I,J-1)+DALPHA
      MMM = MMM+1
      IF (MMM.GT.51) GO TO 40
      DO 39 J=MMM,51
      ANORM(I,J) = 0.0
   39 QNORM(I,J)=0.0
   40 CONTINUE
C*****      IF THERE ARE ANY NATURAL CHANNELS TO DESCRIBE  CALL NATSEC
  41  IF(NCHANL.GT.0) CALL NATSEC
C
C********WRITE DATA DESCRIBING DIFFERENT TYPES OF SEWER ELEMENTS(IF
C        DESIRED)
C  41 CONTINUE
      IF(KPRINT.NE.1) GO TO 45
      WRITE (6,970)
  970 FORMAT ('0NTYPE  DESCRIPTION       ALFMAX  PSIMAX  AFACT   RFACT  K
     1DEPTH  KLASS  INDEX  ANORM   QNORM    DNORM')
      DO 43 I=1,15
      MMM = MM(I)
      IF (MM(I).LT.NN(I)) MMM = NN(I)
   43 WRITE (6,971) I,(NAME(J,I),J=1,4),ALFMAX(I),PSIMAX(I),AFACT(I),
     1 RFACT(I),KDEPTH(I),KLASS(I),(J,ANORM(I,J),QNORM(I,J),DNORM(I,J),
     2 J=1,MMM)
  971 FORMAT (I4,4X,4A4,F7.4,3F8.4,I5,I7,I8,F8.3,2F9.5,/(67X,I8,F8.3,
     1 2F9.5))
      WRITE(6,972)
  972 FORMAT ('0 NON-CONDUITS'//'    NTYPE  KDEPTH  KLASS  DESCRIPTION')
C****    NEXT CARD CHANGED BY TS OF EH%A ON  1/25/76       *************
      WRITE(6,973)  (I,KDEPTH(I),KLASS(I),(NAME(K,I),K=1,4),I=26,35)
  973 FORMAT('0',I6,I7,I8,4X,4A4)
C
C********READ IN DATA FOR EACH SEWER SYSTEM
C
C     READ IN TITLE FOR DATA.
C
   45 READ(5,903) (TITLE(I),I=1,20)
C
C     READ IN EXECUTION DATA.
C
      READ (5,901) NE,NDT,NINPUT,NNYN,NNPE,NOUTS,NPRINT,NPOLL,NITER
C
C              NE     = TOTAL NUMBER OF ELEMENTS
C              NDT    = NUMBER OF TIME STEPS
C              NINPUT = NUMBER OF INPUT ELEMENTS
C              NNYN   = NUMBER OF ELEMENTS FOR WHICH INFLOW
C                       PRINTOUT IS DESIRED
C              NNPE   = NUMBER OF ELEMENTS FOR WHICH OUTFLOW
C                       PRINTOUT IS DESIRED
C              NOUTS  = NUMBER OF ELEMENTS FOR WHICH OUTFLOW
C                       HYDROGRAPHS AND POLLUTOGRAPHS ARE TO BE
C                       PROVIDED ON TAPE FOR INTERFACING
C              NPRINT = 0 NO TRACING MESSAGES GENERATED
C                       1 TRACING MESSAGES ARE GENERATED IN ROUTE
C                       2 TRACING MESSAGES ARE GENERATED IN ROUTE AND
C                         TRANS
C              NPOLL  = NUMBER OF POLLUTANTS TO BE ROUTED
C              NITER  = NUMBER OF ITERATIONS IN ROUTING SCHEME
C
      READ(5,900)DT,EPSIL,DWDAYS
C
C              DT     = LENGTH OF TIME STEP IN SECONDS
C              EPSIL  = CONVERGENCE CRITERIA IN ROUTING
C              DWDAYS = NUMBER OF DRY WEATHER DAYS PRIOR TO STORM
C
C     ASSIGN DEFAULT VALUES
      IF(NITER.LE.0) NITER=4
      IF (EPSIL.LE.0.0) EPSIL = 0.0001
C
      READ(5,901) NCNTRL,NINFIL,NFILTH,JPRINT,JPLOT,NDESN
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C                                                                       TRAN154
C             NCNTRL = 1 IF INPUT INFORMATION IS FROM CARDS             TRAN155
C                      0 IF INPUT INFORMATION IS ON TAPE                TRAN156
C             NINFIL = 1 IF INFILTRATION ROUTINE IS TO BE CALLED        TRAN157
C                      0 IF INFITRATION ROUTINE IS NOT TO BE CALLED     TRAN158
C             NFILTH = 1 IF DRY WEATHER FLOW ROUTINE IS TO BE CALLED    TRAN159
C                      0 IF DRY WEATHER FLOW ROUTINE IS NOT TO BE CALLEDTRAN160
C           * JPRINT = 1 IF PRINTING ROUTINE IS TO BE CALLED            TRAN161
C                      0 IF PRINTING ROUTINE IS NOT TO BE CALLED        TRAN162
C             JPLOT  = 1 IF PLOTTING ROUTINE IS TO BE CALLED FROM WITHINTRAN163
C                      0 IF PLOTTING ROUTINE NOT CALLED FROM WITHIN     TRAN164
C             NDESN  = 1 IF DESIGN ROUTINE IS TO BE CALLED              TRAN165
C                      0 IF DESIGN ROUTINE NOT CALLED                   TRAN166
C     * = NOT OPERATIONAL                                               TRAN167
C                                                                       TRAN168
C     READ IN ELEMENT DATA AND INITIALIZE VARIABLES,                    TRAN169
C                                                                       TRAN170
      I = 1                                                             TRAN171
       KSTOR = 0                                                        TRAN172
       NSTOR = 0                                                        TRAN173
      ICOST(1)=0                                                        TRAN174
      ICOST(2)=0                                                        TRAN175
      DO 47 K=1,NE                                                      TRAN176
      READ(5,902)NOE(K),(NUE(K,J),J=1,3),NTYPE(K),DIST(K),GEOM1(K),SLOPETRAN177
     1(K),ROUGH(K),GEOM2(K),BARREL(K),GEOM3(K)                          TRAN178
  902 FORMAT(5I4,7F8,3)                                                 TRAN179
C                                                                       TRAN180
C     ASSIGN DEFAULT VALUES                                             TRAN181
C                                                                       TRAN182
      IF(BARREL(K),LT,1,0) BARREL(K)=1,0                                TRAN183
      IF(GEOM1(K),LE,0,0) GEOM1(K)=0,0                                  TRAN184
C****    NEXT CARD CHANGED BY TS OF EH%A ON  1/25/76       *************
      IF (NTYPE(K),LE,25,AND.SLOPE(K),LE,0,0) SLOPE(K)=0.1              TRAN185
      IF(ROUGH(K).LE,0,0.AND,NTYPE(K),LE,15)  ROUGH(K)=0,0130           TRAN186
C****    THE NEXT 7 CARDS WERE ADDED BY TS OF EH%A ON 1/25/76  ********
C        ASSIGN CALCULATED ROUGHNESS OF NATURAL SECTION WHEN FULL
C        UNLESS A VALUE IS READ IN
      IF(NTYPE(K),LT,16.OR,NTYPE(K).GT,25) GO TO 55
      NT = NTYPE(K)
      IF(ROUGH(K),LE,0,0) ROUGH(K) = RUF(NT-15)
   55 CONTINUE
C
C     ASSUME MANHOLE IF NONE SPECIFIED                                  TRAN187
C****    NEXT CARD CHANGED BY TS OF EH%A ON  1/25/76       *************
      IF(NTYPE(K),LE,0) NTYPE(K)=26                                     TRAN188
C                                                                       TRAN189
        KSTORE(K) = 0                                                   TRAN190
C****    NEXT CARD CHANGED BY TS OF EH%A ON  1/25/76       *************
      IF(NTYPE(K) ,NE, 29) GO TO 54                                     TRAN191
        KSTOR     = KSTOR + 1                                           TRAN192
        KSTORE(K) = KSTOR                                               TRAN193
        NSTOR     = KSTOR                                               TRAN194
   54 CONTINUE                                                          TRAN195
      QFULL(K) = 0,0                                                    TRAN196
      QMAX(K)=0,0                                                       TRAN197
      AFULL(K)=0,0                                                      TRAN198
      NNEED = NOE(K)                                                    TRAN199
   47 NIN(NNEED) = K                                                    TRAN200
C                                                                       TRAN201
C********READ DATA FOR STORAGE ELEMENTS                                 TRAN202
C                                                                       TRAN203
      IF (NSTOR ,GT, 2)  GO TO 9000                                     TRAN204
      IF (NSTOR ,GT, 0)  CALL TSTRDT                                    TRAN205
C                                                                       TRAN206
C********SEQUENCE ELEMENT DATA                                          TRAN207
C                                                                       TRAN208
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      WRITE(6,44) (TITLE(I),I=1,20)
   44 FORMAT(1H1,//,1X,20A4,//)
      IF(NCNTRL,EQ.1) WRITE(6,46)
   46 FORMAT(' ********************************',/,
     1       ' **********  INPUT HYDROGRAPHS AND POLLUTOGRAPHS ARE READ
     1FROM CARDS  **********',/,' ********************************',//)
      CALL SLOP
C
C********CALCULATE CONSTANTS AND FLOW PARAMETERS FOR EACH ELEMENT
C
      CALL FIRST(MI,0)
C
C********INTERFACING MECHANISM FOR QUANTITY AND QUALITY OF RUNOFF
C
      INCNT=INCNT+1
      IOUTCT=IOUTCT+1
      NTRIN=JIN(INCNT)
      NTROUT=JOUT(IOUTCT)
C     BYPASS TAPE OPERATIONS IF DESIRED
      IF(NCNTRL,GT,0) GO TO 59
C
C********READ HEADING INFORMATION ON INPUT TAPE
C
      REWIND NTRIN
      READ(NTRIN)(TITLE(I),I=1,40)
      READ(NTRIN)   NDT,NINPUT, NPOLL,   DT,TZERO,TAREA
C
C     READ ELEMENT NOS, AT WHICH HYDROGRAPHS AND POLLUTOGRAPHS ARE
C     ENTERED, THIS MUST ALSO BE THE ORDER IN WHICH HYDROGRAPH AND
C     POLLUTOGRAPH ORDINATES APPEAR AT EACH TIME STEP,
C
      READ(NTRIN) (NORDER(I),I=1,NINPUT)
C
C********WRITE HEADING INFORMATION ON OUTPUT TAPE
C
C
C********WRITE DESCRIPTION OF RUN AND SEWER SYSTEM
C
   59 CONTINUE
      WRITE (6,44)  (TITLE(I),I=1,20)
      IF(NDESN,EQ,1) WRITE(6,914)
  914 FORMAT(5X,'***  HYDRAULIC DESIGN ROUTINE IS USED  ***',//)
      WRITE(6,915)NE,NDT,DT
  915 FORMAT(T10,'NUMBER OF ELEMENTS =',I5,/,T10,'NUMBER OF TIME INT =',
     1I5,/,T10,'TIME INTERVAL      =',F6,1,' SECONDS')
      WRITE (6,916)
  916 FORMAT(/,' * * * * *  ELEMENT PARAMETERS  * * * * *',//,' EXT, TYP
     *E  DESCRIPTION',7X,                                        'SLOPE
     1 DISTANCE  MANNING    GEOM1  GEOM2  GEOM3  NUMBER   AFULL   QFULL
     2   QMAX    SUPER-CRITICAL'/,' ELE,'24X,'(FT/FT)   (FT)    ROUGHNES
     3S   (FT)    (FT)    (FT)     OF     (SQ,FT)  (CFS)     (CFS)   FLOW WHE
     4N LESS'/,' NUM,'74X,'BARRELS'27X,'THAN 95( FULL^')
      DO 48 I=1,NE
      NT = NTYPE(I)
   48 WRITE (6,920) NOE(I),NT,(NAME(J,NT),J=1,4),SLOPE(I),DIST(I),
     1ROUGH(I),GEOM1(I),GEOM2(I),GEOM3(I),BARREL(I),AFULL(I),QFULL(I),
     2QMAX(I),SCF(1)
  920 FORMAT(I5,I4,4X,4A4,F7,4,F8,1,F10,4,F8,1,2F7,1,F8,1,3F9,3,5X,A4)
      WRITE(6,913) EPSIL,NITER
  913 FORMAT (///'  EPSILON = 'F8,6,5X,'NO, OF ITERATIONS IN ROUTING ROU
     TINE =',I5,///)
C
C********INITIALIZATION
C
      NEE=NE+1
      DO 50 K=1,NEE
      IOLD(K)=1                                                         TRAN275
      QINFIL(K)=0,0                                                     TRAN276
      QDWF(K)=0,0                                                       TRAN277
      SCOUR(K)=0,0                                                      TRAN278
      RANK(K,2)=0,0                                                     TRAN279
      RANK(K,3)=0,0                                                     TRAN280
      RANK(K,4)=0,0                                                     TRAN281
      IR(K)=NINPUT+1                                                    TRAN282
      DO 50 L=1,NPOLL                                                   TRAN283
      WDWF(K,L)=0,0                                                     TRAN284
   49 PLUTO(K,L)=0.0                                                    TRAN285
      DO 50 I=1,2                                                       TRAN286
      CPOL1(K,I,L) = 0,0                                                TRAN287
      CPOL2(K,I,L) = 0,0                                                TRAN288
      DO 50 II=1,2                                                      TRAN289
      A(K,II,I)=0,0                                                     TRAN290
   50 Q(K,II,I)=0,0                                                     TRAN291
      QO(NE+1)=0,0                                                      TRAN292
      QI(NE+1)=0,0                                                      TRAN293
C****    NEXT CARD CHANGED BY TS OF EH%A ON  1/25/76        *************
      NTYPE(NE+1)=26                                                    TRAN294
      NPOLS=NPOLL+1                                                     TRAN295
      KDAY=1                                                            TRAN296
      KHOUR=1                                                           TRAN297
      KMINS=0                                                           TRAN298
      TIME=0,0                                                          TRAN299
      RNOFF(NINPUT+1)=0,0                                               TRAN300
      DO 51 I=1,NPOLL                                                   TRAN301
      PLUTO(NINPUT+1,I)=0,0                                             TRAN302
   51 CPOL2(NE+1,2,I) =0,0                                              TRAN303
      DO 52 I=1,7                                                       TRAN304
      DVDWF(I)=1,0                                                      TRAN305
      DVBOD(I)=1,0                                                      TRAN306
   52 DVSS(I)=1,0                                                       TRAN307
      DO 53 I=1,24                                                      TRAN308
      HVDWF(I)=1,0                                                      TRAN309
      HVBOD(I)=1,0                                                      TRAN310
   53 HVSS(I)=1,0                                                       TRAN311
C                                                                       TRAN312
C********READ ELEMENT NUMBERS FOR WHICH OUTPUT IS TO BE PROVIDED ON TAPETRAN313
C                                                                       TRAN314
      READ(5,901)(JN(I),I=1,NOUTS)                                      TRAN315
      IF(NPOLL,GT,0) WRITE(6,917) (JN(I),I=1,NOUTS)                     TRAN316
  917 FORMAT ('0HYDROGRAPHS AND POLLUTOGRAPHS PROVIDED TO SUBSEQUENT PROTRAN317
     1GRAMS FOR THE FOLLOWING ELEMENTS:'//(10I5))                       TRAN318
      IF(NPOLL,LT,1) WRITE(6,918) (JN(I),I=1,NOUTS)                     TRAN319
  918 FORMAT('0HYDROGRAPHS PROVIDED TO SUBSEQUENT BLOCKS FOR THE FOLLOWITRAN320
     1NG ELEMENTS:',//,(10I5))                                          TRAN321
C                                                                       TRAN322
C                                                                       TRAN323
      IF(NCNTRL,EQ,1)READ(5,901) (NORDER(I),I=1,NINPUT)                 TRAN324
C     NORDER =" 16I5 FORMAT                                             TRAN325
C                                                                       TRAN326
      DO 60 I=1,NINPUT                                                  TRAN327
      NNEED=NORDER(I)                                                   TRAN328
      NNEED=NIN(NNEED)                                                  TRAN329
   60 IR(NNEED)= I                                                      TRAN330
C                                                                       TRAN331
C********PERFORM SCRATCH TAPE OPERATIONS                                TRAN332
C                                                                       TRAN333
C     READ IN ELEMENT NUMBERS FOR WHICH INPUT POLLUTOGRAPHS AND         TRAN334
C     HYDROGRAPHS TO BE STORED AT ALL TIME STEPS,                       TRAN335
C                                                                       TRAN336
      READ(5,901)(NYN(I),I=1,NNYN)                                      TRAN337
C                                                                       TRAN338
C     READ IN ELEMENT NUMBERS FOR WHICH OUTPUT POLLUTOGRAPHS AND        TRAN339
```

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C     HYDROGRAPHS TO BE STORED AT ALL TIME STEPS,
C
      READ(5,901)(NPE(I),I=1,NNPE)
C********STORE PRINT INFORMATION ON SCRATCH TAPES
C
C
      DO 62 III=1,2
      NTX=NSCRAT(III)
      REWIND NTX
      IF(III,GT,1) GO TO 61
      WRITE(NTX) NDT,NNYN,NPOLL,NNPE,DT,JPRINT,JPLOT
      WRITE(NTX) (NYN(I),I=1,NNYN)
      GO TO 62
   61 WRITE(NTX) NDT,NNPE,NPOLL,NNPE,DT,JPRINT,JPLOT
      WRITE(NTX) (NPE(I),I=1,NNPE)
   62 CONTINUE
C
C********DETERMINE AVERAGE DAILY DWF AND INFILTRATION
C
C     DATA IS READ FROM BOTH OF THESE SUROUTINES
      IF(NINFIL,EQ.1) CALL INFIL
C
      IF(NFILTH,EQ.1) CALL FILTH
C
C********INITIALIZE FLOWS, AREAS, CONCENTRATIONS AND DEPOSITION
C
      N = 0
      IF(NPOLL,GT,0) CALL DWLOAD(DWDAYS)
      DO 64 I=1,NE
   64 RANK(I,1)=SCOUR(I)
C
      CALL INITAL
      IISURG=0
C
      IF(NCNTRL,EQ.1) READ(5,900) TZERO
C               TZERO =" 8F10,0
C
      REWIND NTROUT
      WRITE(NTROUT)(TITLE(I),I=1,40)
      WRITE(NTROUT) NDT,NOUTS,NPOLL,DT,TZERO,TAREA
      WRITE(NTROUT)(JN(N),N=1,NOUTS)
C
C********BEGIN MAIN LOOPS OF PROGRAM
C********OUTER LOOP ON TIME, INNER LOOP ON ELEMENT NUMBER
C
      DO 200 N=1,NDT
C     UPDATE TIME OF DAY
      TIME=TIME+DT
      KMINS=KMINS+INT(DT)/60
      IF(KMINS,GT,60) KHOUR=KHOUR+1
      IF(KMINS,GT,60) KMINS=KMINS-60
      IF(KHOUR,GT,24) KDAY=KDAY+1
      IF(KHOUR,GT,24) KHOUR=1
      IF(KDAY,GT,7) KDAY=1
C
C******** READ INPUT FROM TAPE/DISK AT EACH TIME STEP




C
```

```
C     READ INPUT HYDROGRAPH AND POLLUTOGRAPH ORDINATES AT EACH TIME STEPTRAN397
C                                                                       TRAN398
      IF(NCNTRL,LE,0)                                                   TRAN399
     1READ(NTRIN) DTIM,(RNOFF(I),I=1,NINPUT),((PLUTO(I,J),J=1,NPOLL),   TRAN400
     1I=1,NINPUT)                                                       TRAN401
      IF(NCNTRL,LT,1) GO TO 63                                          TRAN402
C                                                                       TRAN403
C********* READ INPUT FROM CARDS AT EACH TIME STEP                      TRAN404
C                                                                       TRAN405
C                                                                       TRAN406
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C                                                                       TRAN396
C     READ INPUT HYDROGRAPH AND POLLUTOGRAPH ORDINATES AT EACH TIME STEPTRAN397
C                                                                       TRAN398
      IF(NCNTRL,LE,0)                                                   TRAN399
     1READ(NTRIN) DTIM,(RNOFF(I),I=1,NINPUT),((PLUTO(I,J),J=1,NPOLL),   TRAN400
     1I=1,NINPUT)                                                       TRAN401
      IF(NCNTRL,LT,1) GO TO 63                                          TRAN402
C                                                                       TRAN403
C********* READ INPUT FROM CARDS AT EACH TIME STEP                      TRAN404
C                                                                       TRAN405
C                                                                       TRAN406
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C   PLUTO(I,J)  THREE POLLUTANTS PER JUNCTION   [BOD,SS,COLIF[          TRAN407
C   ONE JUNCTION PER CARD                                               TRAN408
C                                                                       TRAN409
      DTIM = DTIM + DT                                                  TRAN410
      IF(NDT,EQ,1) DTIM = TZERO                                         TRAN411
      READ(5,9900) (RNOFF(I),(PLUTO(I,J),J=1,NPOLL),I=1,NINPUT)         TRAN412
 9900 FORMAT(4F10,0)                                                    TRAN413
C                                                                       TRAN414
   63 CONTINUE                                                          TRAN415
C                                                                       TRAN416
C********CONVERT INFLOW POLLUTOGRAPHS TO LBS/SEC OR MPN/SEC             TRAN417
C                                                                       TRAN418
      IF(NPOLL,LT,1) GO TO 6008                                         TRAN419
      DO 68 ND=1,NINPUT                                                 TRAN420
      DO 68 NJ=1,NPOLL                                                  TRAN421
   68 PLUTO(ND,NJ)=PLUTO(ND,NJ)/60.                                     TRAN422
 6008 CONTINUE                                                          TRAN423
C                                                                       TRAN424
C********BEGIN INNER LOOP ON ELEMENT NUMBER                             TRAN425
C                                                                       TRAN426
      DO 150 I=1,NE                                                     TRAN427
C     M=CURRENT ELEMENT NUMBER,(INTERNAL NUMBER),                       TRAN428
      M=JR(I)                                                           TRAN429
C                                                                       TRAN430
C     STORE INPUT HYDROGRAPHS AND POLLUTOGRAPHS FOR DESIRED ELEMENTS    TRAN431
C                                                                       TRAN432
      DO 70 J=1,NNYN                                                    TRAN433
      IF(NOE(M)-NYN(J)) 70,69,70                                        TRAN434
   69 NNEED=IR(M)                                                       TRAN435
      OUTIN(J,1) = RNOFF(NNEED)                                         TRAN436
      IF(NPOLL,LT,1) GO TO 71                                           TRAN437
      DO 81 JJ=2,NPOLS                                                  TRAN438
C     CONVERT INLET POLLUTOGRAPH TO LBS/MIN OR MPN/MIN FOR PRINT ONLY   TRAN439
   81 OUTIN(J,JJ)= PLUTO(NNEED,JJ-1) * 60.                              TRAN440
      GO TO 71                                                          TRAN441
   70 CONTINUE                                                          TRAN442
C                                                                       TRAN443
   71 INPUT=M                                                           TRAN444
C                                                                       TRAN445
C********CORRECT DWF FOR TEMPORAL VARIATIONS                            TRAN446
C                                                                       TRAN447
      IF(NPOLL,LT,1) GO TO 72                                           TRAN448
C     CORRECT SEWAGE FOR DAILY VARIATION                                TRAN449
C     WDWF(INPUT,1) IS B O D IN LBS/SEC                                 TRAN450
C     WDWF(INPUT,2) IS SS IN LBS/SEC                                    TRAN451
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C     WDWF(INPUT,3) IS COLIFORM IN MPN/SEC                            TRAN452
      WDWF1=WDWF(INPUT,1)*DVBOD(KDAY)*DVDWF(KDAY)                     TRAN453
      WDWF2=WDWF(INPUT,2)*DVSS(KDAY)*DVDWF(KDAY)                      TRAN454
      WDWF3=WDWF(INPUT,3)*1,0*DVDWF(KDAY)                             TRAN455
C     CORRECT SEWAGE FOR HOURLY VARIATION                             TRAN456
      DUMY2=WDWF1*HVBOD(KHOUR)*HVDWF(KHOUR)                           TRAN457
      DUMY3=WDWF2*HVSS(KHOUR)*HVDWF(KHOUR)                            TRAN458
      DUMY5=WDWF3*HVCOLI(KHOUR)*HVDWF(KHOUR)                          TRAN459
   72 DDWF=QDWF(INPUT)*DVDWF(KDAY)                                    TRAN460
      DUMY1=DDWF*HVDWF(KHOUR)                                         TRAN461
C                                                                     TRAN462
C********SUM UPSTREAM FLOWS                                           TRAN463
C                                                                     TRAN464
      TOTAL=0,0                                                       TRAN465
      DO 80 J=1,3                                                     TRAN466
      NNEED=INUE(M,J)                                                 TRAN467
      NTU = NTYPE(NNEED)                                              TRAN468
C****    NEXT CARD CHANGED BY TS OF EH%A ON  1/25/76        *************
      IF (NTU,LE.27.OR,NTU.GE,33) GO TO 79                            TRAN469
C     HERE IF UPSTREAM ELEMENT IS OF FLOW DIVIDER TYPE,               TRAN470
      L = GEOM3(NNEED)                                                TRAN471
      QQ = QO2(NNEED)                                                 TRAN472
      IF (NOE(M),EQ.L) QQ = QO1(NNEED)                                TRAN473
      TOTAL = TOTAL+QQ                                                TRAN474
      GO TO 80                                                        TRAN475
   79 TOTAL = TOTAL+QO(NNEED)                                         TRAN476
   80 CONTINUE                                                        TRAN477
      KFULL=2                                                         TRAN478
      NT = NTYPE(M)                                                   TRAN479
      K = KLASS(NT)                                                   TRAN480
      GO TO (90,90.110),K                                             TRAN481
   90 QI(M) = TOTAL/BARREL(M)                                         TRAN482
C     ASSUME IF QI=EXACTLY QFULL, CONDUIT HAS BEEN DETERMINED TO BE   TRAN483
C     SURCHARGING,                                                    TRAN484
      IF (QI(M),EQ.QFULL(M)) GO TO 95                                 TRAN485
      ITER = NITER                                                    TRAN486
      GO TO 115                                                       TRAN487
   95 KFULL = 1                                                       TRAN488
      ITER = 0                                                        TRAN489
      GO TO 115                                                       TRAN490
C                                                                     TRAN491
C********SUM INFLOWS TO NON-CONDUITS,                                 TRAN492
C                                                                     TRAN493
  110 NNEED= IR(M)                                                    TRAN494
      QI(M) = TOTAL+RNOFF(NNEED)+SURGE2(M)/DT+DUMY1+QINFIL(M)         TRAN495
      RANK(M,2)=RANK(M,2)+RNOFF(NNEED)+DUMY1+QINFIL(M)                TRAN496
      IF(NPOLL,LT,1) GO TO 113                                        TRAN497
      RANK(M,3)=RANK(M,3)+PLUTO(NNEED,1)                              TRAN498
      RANK(M,4)=RANK(M,4)+PLUTO(NNEED,2)                              TRAN499
  113 IF(QI(M),LT,0,0) QI(M)=0,0                                      TRAN500
      ITER = 0                                                        TRAN501
C                                                                     TRAN502
C********ROUTE FLOW THROUGH ELEMENT                                   TRAN503
C                                                                     TRAN504
  115 CALL ROUTE(NITER)                                               TRAN505
C****    NEXT CARD CHANGED BY TS OF EH%A ON  1/25/76        *************
      IF(NT,EQ,29) GO TO 116                                          TRAN506
      ITER = ITER+1                                                   TRAN507
      IF(ITER,GT,NITER) GO TO 115                                     TRAN508
C                                                                     TRAN509
C********MULTIPLY FLOW BY NUMBER OF BARRELS                           TRAN510
C                                                                     TRAN511
  116 QI(M) = QI(M)*BARREL(M)                                         TRAN512
C                                                                     TRAN513
C********SURCHARGE ROUTINE                                            TRAN514
C                                                                     TRAN515
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C     CHECK ELEMENT DOWNSTREAM FROM NON-CONDUIT FOR POSSIBLE            TRAN516
C     SURCHARGING,                                                      TRAN517
      GO TO (1170,1170,1161),K                                          TRAN518
 1161 IF (I,EQ,NE) GO TO 1170                                           TRAN519
      II = 1                                                            TRAN520
 1162 MI = JR(I+II)                                                     TRAN521
C     CHECK TO SEE IF NEXT ELEMENT ROUTED IS DOWNSTREAM ELEMENT,        TRAN522
      IF (INUE(MI,1),EQ,M) GO TO 1163                                   TRAN523
 1164 II = II+1                                                         TRAN524
      IF (I+II-NE) 1162,1162,1170                                       TRAN525
 1163 IFD = 1                                                           TRAN526
      SURTMP = 0,0                                                      TRAN527
      NTI = NTYPE(MI)                                                   TRAN528
      KI = KLASS(NTI)                                                   TRAN529
C     IS CURRENT ELEMENT A FLOW DIVIDER^                                TRAN530
C****     NEXT CARD CHANGED BY TS OF EH%A ON  1/25/76       *************
      IF (NT,LE,27,OR,NT,GE,32) GO TO 1165                              TRAN531
C****     NEXT CARD CHANGED BY TS OF EH%A ON  1/25/76       *************
      IF (NT,EQ,29,AND,GEOM3(M),LE,0,0) GO TO 1165                      TRAN532
C     SET PARAMETER FOR FLOW DIVIDER,                                   TRAN533
      IFD = 2                                                           TRAN534
      L = GEOM3(M)                                                      TRAN535
      IF(MI,EQ,NIN(L)) GO TO 1164                                       TRAN536
      IF (KI,EQ,3) GO TO 1167                                           TRAN537
      QINN = QO2(M)/BARREL(MI)                                          TRAN538
      GO TO 1166                                                        TRAN539
 1165 IF(KI,EQ,3) GO TO 1169                                            TRAN540
      QINN = QO(M)/BARREL(MI)                                           TRAN541
      QO1(M) = 0,0                                                      TRAN542
 1166 IF (QINN,LE,QMAX(MI),AND.IFD,EQ,1) GO TO 1169                     TRAN543
      IF (QINN.LE,QMAX(MI)) GO TO 1167                                  TRAN544
C     IF CONDUIT CAPACITY EXCEEDED, STORE EXCESS AT UPSTREAM NON-CONDUITTRAN545
C     CONDUIT ASSUMED TO FLOW FULL AT UPSTREAM END,                     TRAN546
C     QFULL BASED ON CONDUIT SLOPE,                                     TRAN547
      IISURG=IISURG+1                                                   TRAN548
      IF(IISURG,EQ,1)WRITE(6,9990)                                      TRAN549
 9990 FORMAT(1H1,///)                                                   TRAN550
      QFULL(MI) = P1(MI)*SQRT(SLOPE(MI))                                TRAN551
      SURGE2(M) = (QINN-QFULL(MI))*DT*BARREL(MI)+SURTMP                 TRAN552
      WRITE (6,960) TIME,N,NOE(MI),SURGE2(M),NOE(M)                     TRAN553
  960 FORMAT ('0TIME='F7,0,' SECONDS, TIME STEP='I5,', ELEMENT'I4,' SURCTRAN554
     1HARGING, SURCHARGE OF',F11,2, 'CU, FT, STORED AT UPSTREAM ELEMENT'TRAN555
     2 I4)                                                              TRAN556
C                                                                       TRAN557
C   DESIGN ROUTINE                                                      TRAN558
C                                                                       TRAN559
      RATIO=QINN/QFULL(MI)                                              TRAN560
      WRITE (6,961) RATIO                                               TRAN561
  961 FORMAT (' RATIO OF REQUIRED FLOW TO PRESENT QFULL='F5,2)          TRAN562
      SURTMP = SURGE2(M)                                                TRAN563
      IF(NDESN,EQ,0) GO TO 490                                          TRAN564
      SURTMP=0,0                                                        TRAN565
      KSTORE(MI)=1                                                      TRAN566
C     INCREASE CONDUIT DIMENSION UNTIL SURCHARGE ELIMINATED,            TRAN567
      IF(NTI,NE,2) GO TO 405                                            TRAN568
C     INCREASE WIDTH OF RECTANGULAR CONDUIT BY 0,5 FT,                  TRAN569
      GEOM2(MI)=GEOM2(MI)+0,50                                          TRAN570
      CALL FIRST(MI,1)                                                  TRAN571
      WRITE (6,400) NOE(MI),GEOM2(MI)                                   TRAN572
  400 FORMAT(' INCREASE WIDTH OF EXT ELEMENT ',I4,' BY 0,50 TO 'F7,3,   TRAN573
     1' FT,')                                                           TRAN574
      GO TO 1166                                                        TRAN575
  405 IF(NTI,EQ,1) GO TO 430                                            TRAN576
C     IF NOT CIRCULAR OR RECT,, REPLACE BY CIRCULAR OF EQUAL AREA,      TRAN577
      NTYPE(MI)=1                                                       TRAN578
      NTI=1                                                             TRAN579
      GE=1,12838*SQRT(AFULL(MI))
C     USE STANDARD PIPE SIZES.
      IF(GE,GT,3,0) GO TO 410
      GEOM1(MI)=FLOAT(IFIX(GE*100,)/25+1)*0,25
      GO TO 420
  410 GEOM1(MI)=FLOAT(IFIX(GE*100,)/50+1)*0,50
  420 CALL FIRST(MI,1)
      WRITE (6,415) NOE(MI),GEOM1(MI)
  415 FORMAT(' REPLACE EXT ELEMENT 'I4,' BY CIRCULAR CONDUIT OF DIAMETER
     1 ',F7,3,'FT,')
      GO TO 1166
C     INCREASE DIAMETER OF CIRCULAR CONDUITS BY STANDARD AMOUNTS,
  430 DEL=0,25
      IF(GEOM1(MI),GE,3,0) DEL=0,50
      IF(GEOM1(MI),LT,1,0) DEL=1,0-GEOM1(MI)
      GEOM1(MI)=GEOM1(MI)+DEL
      CALL FIRST(MI,1)
      WRITE (6,480) NOE(MI),DEL,GEOM1(MI)
  480 FORMAT(' INCREASE DIAMETER OF EXT ELEMENT ',I4,' BY ',F4,2,
     1' TO ',F7,3,'FT,')
      GO TO 1166
  490 IF (IFD,EQ,1) GO TO 1168
      QO2(M) = QFULL(MI)*BARREL(MI)
      QO(M) = QO1(M)+QO2(M)
C     CHECK CAPACITY OF SECOND ELEMENT DOWNSTREAM FROM FLOW-DIVIDER,
 1167 L = GEOM3(M)
      MI = NIN(L)
      NTI = NTYPE(MI)
      KI = KLASS(NTI)
      IF (KI,EQ,3) GO TO 1169
      QINN = QO1(M)/BARREL(MI)
      IFD = 1
      GO TO 1166
 1168 QO1(M) = QFULL(MI)*BARREL(MI)
      QO(M) = QO1(M)+QO2(M)
      GO TO 1170
 1169 SURGE2(M) = SURTMP
 1170 CONTINUE
      QO(M) = QO(M)*BARREL(M)
C****    NEXT CARD CHANGED BY TS OF EH%A ON  1/25/76        *************
      IF (NT,EQ,29) GO TO 6600
C
C********ROUTE QUALITY PARAMETERS THROUGH ELEMENT
C
      IF(NPOLL,GT,0) CALL QUAL(DUMY2,DUMY3,0,0,DUMY5)
C
C********STORE DESIRED OUTFLOWS TO BE GENERATED ONTO OUTPUT TAPE
C
 6600 DO 6666 J=1,NOUTS
      IF(NOE(M),NE,JN(J)) GO TO 6666
      OUTTAP(J,1)=QO(M)
      IF(NPOLL,LT,1) GO TO 117
      DO 6620 JJ=2,NPOLS
C     CONVERT POLLUTOGRAPHS TO LBS/MIN OR MPN/MIN FOR INTERFACING
 6620 OUTTAP(J,JJ)=CPOL2(M,2,JJ-1)*QO(M)*60,0
      GO TO 117
 6666 CONTINUE
C
C********STORE DESIRED OUTFLOWS TO BE GENERATED ON SCRATCH TAPE
C        FOR PRINTING PURPOSES
C
  117 DO 124 J=1,NNPE
      IF(NOE(M),NE,NPE(J)) GO TO 124
      OUT(J,1) = QO(M)
      IF(NPOLL,LT,1) GO TO 125
      DO 118 JJ=2,NPOLS
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C     CONVERT OUTFLOW POLLUTOGRAPH TO LBS/MIN OR MPN/MIN FOR PRINT ONLY TRAN645
  118 OUT(J,JJ) = CPOL2(M,2,JJ-1) * QO(M) * 60,0                        TRAN646
      GO TO 125                                                         TRAN647
  124 CONTINUE                                                          TRAN648
C                                                                       TRAN649
C********REPLACE VALUES AT OLD TIME STEP BY VALUES AT NEW ONE           TRAN650
C                                                                       TRAN651
  125 A(M,1,1)=A(M,1,2)                                                 TRAN652
      A(M,2,1)=A(M,2,2)                                                 TRAN653
      IF(NPOLL,LT,1) GO TO 1026                                         TRAN654
      DO 126 IP=1,NPOLL                                                 TRAN655
      CPOL1(M,1,IP) = CPOL1(M,2,IP)                                     TRAN656
  126 CPOL2(M,1,IP) = CPOL2(M,2,IP)                                     TRAN657
 1026 Q(M,1,1)=Q(M,1,2)/BARREL(M)                                       TRAN658
  150 Q(M,2,1)=Q(M,2,2)/BARREL(M)                                       TRAN659
C                                                                       TRAN660
C********STORE DESIRED INPUT HYDROGRAPHS AND POLLUTOGRAPHS ON SCRATCH    TRAN661
C          TAPE,                                                        TRAN662
      NTX=NSCRAT(1)                                                     TRAN663
      DO 140 I=1,NNYN                                                   TRAN664
  140 WRITE(NTX) (OUTIN(I,J),J=1,NPOLS)                                 TRAN665
C                                                                       TRAN666
C********STORE DESIRED OUTPUT HYROGRAPHS AND POLLUTOGRAPHS ON SCRATCH    TRAN667
C          TAPE,                                                        TRAN668
      NTX=NSCRAT(2)                                                     TRAN669
      DO 155 I=1,NNPE                                                   TRAN670
  155 WRITE(NTX) (OUT(I,J),J=1,NPOLS)                                   TRAN671
C                                                                       TRAN672
C********GENERATE OUTPUT TAPE TO BE USED BY INTERFACING MODEL            TRAN673
C                                                                       TRAN674
      TIMX=TIME+TZERO                                                   TRAN675
      WRITE(NTROUT) TIMX, (OUTTAP(J,1),J=1,NOUTS),((OUTTAP(J,KK),KK=2,NPTRAN676
     *OLS),J=1,NOUTS)                                                   TRAN677
C                                                                       TRAN678
      IF(NPRINT,LT,2) GO TO 200                                         TRAN679
      WRITE(6,980)                                                      TRAN680
  980 FORMAT ('    TIME    QFULLS FROM ELEMENT 1 TO NE,')               TRAN681
      WRITE (6,981) TIME,(QFULL(J),J=1,NE)                              TRAN682
  981 FORMAT (F9,2,15F8,2/(9X,15F8,2))                                  TRAN683
  200 CONTINUE                                                          TRAN684
C                                                                       TRAN685
C********PRINT FINAL SOLIDS DEPOSITION                                   TRAN686
C                                                                       TRAN687
      IF(NPOLL,LT,1) GO TO 169                                          TRAN688
      WRITE(6,940)                                                      TRAN689
  940 FORMAT('1',30X,'BED OF SOLIDS IN SEWER AT END OF STORM'///)       TRAN690
      WRITE(6,942)                                                      TRAN691
  942 FORMAT(' ',31X,'ELEMENT',20X,'SOLIDS IN',/,32X,'NUMBER',23X,'BOTTOTRAN692
     1M'/,62X,'(LBS)'///)                                               TRAN693
      DO 333 I=1,NE                                                     TRAN694
      M=JR(I)                                                           TRAN695
      NT=NTYPE(M)                                                       TRAN696
      IF(KLASS(NT),GT,2) GO TO 333                                      TRAN697
      WRITE(6,944) NOE(M),SCOUR(M)                                      TRAN698
  944 FORMAT(' ',30X,I6,20X,F10,5)                                      TRAN699
  333 CONTINUE                                                          TRAN700
      II=0                                                              TRAN701
      DO 989 I=1,NE                                                     TRAN702
C****    NEXT CARD CHANGED BY TS OF EH%A ON  1/25/76        *************
      IF(NTYPE(I),LT,26)GO TO 989                                       TRAN703
      DO 988 J=1,3                                                      TRAN704
      L=INUE(I,J)                                                       TRAN705
C****    NEXT CARD CHANGED BY TS OF EH%A ON  1/25/76        *************
      IF(NTYPE(L),GE,26)GO TO 988                                       TRAN706
      RANK(I,1)=RANK(I,1)+RANK(L,1)-SCOUR(L)                            TRAN707
  988 CONTINUE                                                          TRAN708
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      II=II+1                                                           TRAN709
      IR(II)=I                                                          TRAN710
      RANK(I,5)=RANK(I,1)+RANK(I,4)*DT+WDWF(I,2)*DT*NDT                 TRAN711
  989 CONTINUE                                                          TRAN712
      WRITE(6,990)                                                      TRAN713
  990 FORMAT(1H1,/,' * * * * *  RESULTS OF POLLUTANT MONITORING ROUTINE TRAN714
     1 * * * * *',//,1X,'POLLUTANTS ASSOCIATED WITH MANHOLES (INLET POINTRAN715
     1TS) RANKED IN ORDER OF SIGNIFICANCE OF SUSPENDED SOLIDS,',//,T20, TRAN716
     2'SUSPENDED  SOLIDS (LB)',T55,'5 - DAY BOD (LB)',/,                TRAN717
     2T20,'----------------------',T55,'-----------------',T80,'TOTAL',/,TRAN718
     3T2,'RANK',T8,'INLET',T15,'RUNOFF',T23,'D.W.F.',T31,'P.SCOUR',T39, TRAN719
     4'TOTAL SS',T50,'RUNOFF',T58,'D.W.F.',T66,'TOTAL BOD',T78,'INFLOW (TRAN720
     5CF) ',/)                                                          TRAN721
      DO 995 I=1,II                                                     TRAN722
      BIG=-1.0E+50                                                      TRAN723
      DO 991 LL=1,II                                                    TRAN724
      L=IR(LL)                                                          TRAN725
      IF(RANK(L,5).LE.BIG)GO TO 991                                     TRAN726
      BIG=RANK(L,5)                                                     TRAN727
      LBIG=L                                                            TRAN728
  991 CONTINUE                                                          TRAN729
      RANK(LBIG,4)=RANK(LBIG,4)*DT                                      TRAN730
      WDWF(LBIG,2)=WDWF(LBIG,2)*DT*NDT                                  TRAN731
      RANK(LBIG,3)=RANK(LBIG,3)*DT                                      TRAN732
      WDWF(LBIG,1)=WDWF(LBIG,1)*DT*NDT                                  TRAN733
      TBOD=RANK(LBIG,3)+WDWF(LBIG,1)                                    TRAN734
      WRITE(6,992)I,NOE(LBIG),RANK(LBIG,4),WDWF(LBIG,2),RANK(LBIG,1),   TRAN735
     1RANK(LBIG,5),RANK(LBIG,3),WDWF(LBIG,1),TBOD,RANK(LBIG,2)          TRAN736
  992 FORMAT(1X,I3,2X,I4,3X,E8.3,1X,E8.3,1X,F5.2,2X,E8.3,2X,F7.2,1X,    TRAN737
     1E8.3,1X,E8.3,5X,E8.3)                                             TRAN738
  995 RANK(LBIG,5)=-1.0E+51                                             TRAN739
  169 WRITE(6,44) (TITLE(I),I=1,20)                                     TRAN740
      WRITE(6,910)TIME,DT                                               TRAN741
  910 FORMAT (' TOTAL SIMULATION TIME ='F8.1,' SECONDS, TIME STEP ='F6.1TRAN742
     1, ' SECONDS.')                                                    TRAN743
      IF(NPOLL.GT.0) WRITE(6,925) (NORDER(I),I=1,NINPUT)                TRAN744
  925 FORMAT(//' INFLOW POLLUTOGRAPHS AND HYDROGRAPHS AT THE FOLLOWING ETRAN745
     1XTERNAL ELEMENT NUMBERS:',//,(20I5))                              TRAN746
      IF(NPOLL.LT.1) WRITE(6,9250)(NORDER(I),I=1,NINPUT)                TRAN747
 9250 FORMAT(//' INFLOW HYDROGRAPHS AT THE FOLLOWING EXTERNAL ELEMENT NUTRAN748
     1MBERS:',//,(20I5))                                                TRAN749
C                                                                       TRAN750
C********PRINT TOTAL HYDROGRAPHS AND POLLUTOGRAPHS FOR DESIRED ELEMENTS TRAN751
C                                                                       TRAN752
      IF(JPRINT.NE.1) GO TO 170                                         TRAN753
      CALL PRINT                                                        TRAN754
C                                                                       TRAN755
  170 CONTINUE                                                          TRAN756
C                                                                       TRAN757
      CALL TSTCST                                                       TRAN758
C     IF (NDESN.EQ.0) RETURN                                            TRAN759
      IF (NDESN.EQ.0) GO TO 5000
      WRITE (6,930)                                                     TRAN760
  930 FORMAT (1H1,///,' HYDRAULIC DESIGN ROUTINE FINAL RESULTS,',//,    TRAN761
     1' FINAL CONDUIT DIMENSIONS, ASTERISK INDICATES ALTERED CONDUITS,',TRAN762
     2//)                                                               TRAN763
      CALL FIRST(MI,2)                                                  TRAN764
      WRITE(6,916)                                                      TRAN765
      DO 300 I=1,NE                                                     TRAN766
      NT=NTYPE(I)                                                       TRAN767
C****    NEXT CARD CHANGED BY TS OF EH%A ON  1/25/76        *************
      IF(NT.GE.26) GO TO 300                                            TRAN768
      QQ=BLANK                                                          TRAN769
      IF(KSTORE(I).EQ.1) QQ=ASTER                                       TRAN770
      WRITE (6,931) NOE(I),NT,QQ,(NAME(J,NT),J=1,4),SLOPE(I),DIST(I),   TRAN771
     1ROUGH(I),GEOM1(I),GEOM2(I),GEOM3(I),BARREL(I),AFULL(I),QFULL(I),  TRAN772
     [illegible]
     2QMAX(I),SCF(I)                                                    TRAN773
  931 FORMAT (2I5,2X,A1,4A4,F8,5,F9,2,F9,4,F9,3,2F7,3,F6,1,3F9,3,5X,A4) TRAN774
  300 CONTINUE                                                          TRAN775
      GO TO 9999                                                        TRAN776
C-------------------ERROR MESSAGES-----------------------------------    TRAN777
 9000 WRITE(6,690) NSTOR                                                TRAN778
  690 FORMAT('0 *** THE NUMBER OF STORAGE UNITS,  NSTOR =', I5,         TRAN779
     *        ', MUST NOT EXCEED  2')                                   TRAN780
C9999 RETURN                                                            TRAN781
 9999 CONTINUE
 5000 CONTINUE
      END                                                               TRAN782
*DECK,NATSEC
      SUBROUTINE NATSEC
C     PROGRAM NATSEC (INPUT,OUTPUT,TAPE5=INPUT,TAPE6=OUTPUT)
C
C     THIS ROUTINE WILL CALCULATE AREA OF AN   IRREGULAR CROSS SECTION
C     IN AN OPEN CHANNEL,  DETERMINE AND STORE TABULAR VALUES OF Q/QFULL
C      A/AFULL AND THE CORRESPONDING EQUIVALENT N VALUE TO BE USED IN
C     MANNING'S FORMULA,
C
      COMMON/TABLES/ KDEPTH(35),KLASS(35),PSIMAX(25),ALFMAX(25),NN(35),
     1               MM(35),ANORM(25,51),QNORM(25,51),DNORM(25,51),
     2   AFACT(25),  RFACT(25)
      COMMON /NAMES/ NAME(4,35),GNO,YES,BLANK
      COMMON /NVALUE/ RUF(10)
C
      DIMENSION ASTER(2),TYPE(4),LEVEL1(2),LEVEL2(2)
      DIMENSION X(15),Y(15),S(15),RN( 3),A(15)
      DIMENSION RUFN(10,51)
      DATA ASTER/4H****,4H*** /,TYPE/4HNATU,4HRAL ,4HSECT,4HION /,
     1     LEVEL1/4HFATA,4HL   /,LEVEL2/4HWARN,4HING /
      IN= 5
      IOUT =6
      NT = 15
      IABORT = 0
C        CLEAR ARRAYS
      DO 5 J=16,25
      DO 5 J1=1,51
      QNORM(J,J1)=0,0
      DNORM(J,J1) = 0,0
 5    ANORM(J,J1) = 0,0
 10   DO 15 J=1,15
      X(J)=0,0
      Y(J)=0,0
      A(J) = 0,0
 15    S(J) = 0,0
      RN(1) = 0,0
      RN(2) = 0,0
      RN(3) = 0,0
C        READ CONTROL PARAMETERS THEN CROSS SECTION DATA
      NT = NT + 1
      IF(NT,GT,25)READ(IN,55)NOCO
      IF(NT,GT,25)GO TO 40
      READ(IN,55) NOCO,NSEC,XLOB,XROB,(NAME(J,NT),J=1,4)
  55  FORMAT(2I5,2F10,2,10X,4A4)
  40  IF(NOCO,EQ,0) GO TO 1000
      IF(NT,GT,25) WRITE(IOUT,25)ASTER,LEVEL1,TYPE
  25  FORMAT(1H0,8A4,46H MORE THAN 10 CHANNEL SECTIONS ARE BEING INPUT)
      IF(NT,GT,25)STOP
      WRITE(IOUT,950)
      WRITE(IOUT,56)  (NAME(J,NT),J=1,4),NOCO,NSEC
  56  FORMAT(1H0,10X,18HNAME OF CHANNEL - ,4A4,//,11X,
     1   38HNUMBER OF POINTS DESCRIBING CHANNEL - ,I5,/,11X,
     2   48HNUMBER OF INCREMENTS FOR AREA DISCHARGE CURVE - ,I5)
      IF(NOCO.GT.15) IABORT = 1
      IF(NSEC,GT,50) IABORT = 1
      IF(XLOB,GE,XROB,AND,XLOB,NE,0,0) GO TO 58
      GO TO 59
   58 IABORT = 1
      WRITE(IOUT,57)  ASTER,LEVEL1,TYPE,XLOB,XROB
   57 FORMAT(1H0,8A4,42H LEFT OVERBANK STATION IS GREATER THAN OR , /,
     1   25X,42HEQUAL TO RIGHT OVERBANK STATION -  XLOB = ,F10.4,5X,
     2   7HXROB = ,F10,4)
   59 IF(IABORT,EQ,0) GO TO 75
      WRITE(IOUT,60) NOCO,NSEC,(NAME(J,NT),J=1,4)
  60  FORMAT(1H1,5(2H**),43H  CONTROL CARD IN ERROR FOR NATURAL SECTION,
     1       40H INPUT DATA,  CARD AS READ FOLLOWS,,,    , //,1H ,
     2       35H1,,.5,,.10,,,15,,.20,,25,,,,,,,,30,/,1H ,2I5,     10X,4A4
     3,//,1H ,5(2H**),40H  PROGRAM ABORTED FROM ROUTINE -NATSEC- )
      STOP
  75  I= NOCO - 1
      KLASS(NT) = 2
      KDEPTH(NT) = 2
C
      WRITE(IOUT,80) XLOB,XROB
   80 FORMAT(1H0,20X,24HLEFT OVERBANK STATION =  ,F10,2,10X,
     1 25HRIGHT OVERBANK STATION = ,F10,2)
      READ(IN,90) (X(J),Y(J),J=1,NOCO)
  90  FORMAT(10F8,2)
      READ(IN,90)(RN(J),J=1,3)
      WRITE(IOUT,91) RN,(X(J),Y(J),J=1,NOCO)
   91 FORMAT(1H0,10X,39HMANNING'S ROUGHNESS COEFFICIENTS FOR - ,
     1   /,10X,16HLEFT OVERBANK = ,F8,4,5X,15HMAIN CHANNEL = ,
     2   F8,4,5X,17HRIGHT OVERBANK = ,F8,4,
     3   /,  1H0,10X,40HX AND Y VALUES DESCRIBING SECTION ARE - ,
     4   2(/10(1X,F8,2)))
C     DATA ERROR CHECKING
C         TEST FOR INCREASING X VALUES
      DO 94 J=1,I
      IF(X(J),GT,X(J+1)) GO TO 95
  94  CONTINUE
      GO TO 97
  95  WRITE(IOUT,96) ASTER,LEVEL1,TYPE,NT    ,(X(J),J=1,NOCO)
  96  FORMAT(1H0,8A4,9H NTYPE = ,I3,25H X VALUES ARE NOT ALWAYS ,
     1       31HINCREASING, VALUES OF X FOLLOW,,//,1H ,10(F8,2,2X),/,1H ,
     2       5(F8,2,2X))
      IABORT = 1
C     TEST FOR LEVEE IN Y VALUES
  97  ITEST = 0
      DO 98 J=1,I
      IF(Y(J),LT,Y(J+1),AND,ITEST,EQ,0) ITEST = 1
      IF(Y(J),GT,Y(J+1),AND,ITEST,EQ,1) GO TO 99
  98  CONTINUE
      GO TO 100
  99  WRITE(IOUT,101) ASTER,LEVEL1,TYPE,NT    ,(Y(J),J=1,NOCO)
 101  FORMAT(1H0,8A4,9H NTYPE = ,I3,31H Y VALUES INDICATE EXISTANCE OF,
     1       28H LEVEE, VALUES LISTED BELOW,,//,1H ,10(F8,2,2X),/,1H ,
     2        5(F8,2,2X))
      IABORT =1
 100  IF(IABORT,EQ,1) STOP
C
C        ERROR CHECKING COMPLETE
      DFULL = 0,0
      QFULL = 0,0
      AREA = 0,0
      YLOW = Y(NOCO)
      AFULL = 0,0
C        FIND LOWEST Y VALUE AND SLOPES OF SEGMENTS AND AREA FULL
C
      DO 120 J= 1,I
      IF(YLOW.GT.Y(J)) YLOW = Y(J)
```

```
C         FOR VERTICAL SECTION SET SLOPE TO A BIG VALUE
      IF((X(J+1)-X(J)),LE,0,0) GO TO 110
      S(J) = (Y(J+1)-Y(J)) /(X(J+1)-X(J))
      GO TO 120
 110  S(J) = 9,99E+20
 120  CONTINUE
C
      YSUR = Y(NOCO)
      IF(YSUR,GT,Y(1)) YSUR = Y(1)
      YMAX = YSUR
C        ASSIGN DEFAULT VALUE TO YCHAN
      YCHAN = YSUR - YLOW
C        START LOOP AND FIRST TIME THROUGH FIND QFULL,DFULL
      DO 130 J=1,NOCO
      IF(Y(J),GT,YMAX) GO TO 130
      GO TO 140
 130  CONTINUE
      WRITE(IOUT,135) YMAX
 135  FORMAT(1H0,48H***  NO VALUE FOUND FOR Y(J) LESS THAN OR EQUAL ,
     1  /,1H0,   46H***  TO YMAX IN NATSEC AT LOOP 130.  VALUE OF      ,
     2            7HYMAX =     ,F10,5)
      STOP
 140  ILOWPT = J
      JJ = ILOWPT + 1
      DO 150 J= JJ,NOCO
      IF( Y(J),LT,YMAX) GO TO 150
      GO TO 160
 150  CONTINUE
 160  IHIPT = J
      ILOW = ILOWPT
      IHI = IHIPT
      IM = IHI - 1
      IF(Y(ILOWPT),EQ,Y(IHIPT)) GO TO 165
      IF(Y(ILOWPT),LT,YMAX) X(ILOWPT) = X(ILOWPT)+(YMAX-Y(ILOWPT))/
     1    S(ILOWPT-1)
      IF(Y(ILOWPT),LT,YMAX) Y(ILOWPT) = YMAX
      IF(Y(IHIPT),GT,YMAX) X(IHIPT)=X(IHIPT)+(YMAX-Y(IHIPT))/S(IHIPT)
      IF(Y(IHIPT),GT,YMAX) Y(IHIPT) = YMAX
C     FOR AREA FULL
 165  DO 170 J = ILOW  , IM
      A(J) = 0,5*((YSUR-Y(J))+(YSUR-Y(J+1)))*(X(J+1)-X(J))
 170  AFULL = AFULL + (0,5 * ((Y(1)-Y(J))+(Y(1)-Y(J+1)))* (X(J+1)-X(J)))
      AREA = AFULL
      AINCR = AFULL/NSEC
      K = NSEC + 1
      MM(NT) = K
      NN(NT) = K
      ART = 0,0
      ALT = 0,0
      WPLT = 0,0
      WPRT = 0,0
      XRT = X(IHIPT)
      XLT = X(ILOWPT)
      GO TO 702
 220  AREA = AFULL
 240  K = K - 1
      IF(K,LT,1) GO TO 10
      IF(K,EQ,1)GO TO 850
      AREA = AREA - AINCR
 250  YSUR = YLOW + YCHAN
C        FIND FIRST Y VALUES BELOW SURFACE
      DO 300 J= 1,NOCO
      IF(Y(J),LE,YSUR,AND,YSUR,GT,YLOW)GO TO 310
      IF(K,EQ,1,AND,Y(J),LE,YSUR,AND,YSUR,EQ,YLOW)GO TO 310
 300  CONTINUE
      WRITE(IOUT,305) ASTER,LEVEL1,TYPE,NT    ,K,YSUR
 305  FORMAT(1H0,8A4,9H NTYPE = ,I3,28H NO FLOW CONDITION DETECTED,,
    1        5H K = ,I4,5X,6HYSUR =,F15,10)
      STOP
 310  ILOW = J
C        FIND RIGHT SIDE Y VALUE JUST ABOVE SURFACE
      JJ = ILOW + 1
      DO 350 J = JJ,IHIPT
      IF(Y(J)-YSUR) 350,360,370
 350  CONTINUE
      WRITE(IOUT,355) ASTER,LEVEL1,TYPE,NT   ,K,YSUR
 355  FORMAT(1H0,8A4,9H NTYPE = ,I3,30H SURCHARGE CONDITION DETECTED,,
    1        5H K = ,I4,5X,6HYSUR =,F10,3)
      STOP
 360  IHI = J
      GO TO 400
 370  IHI = J - 1
C        CALCULATE NEW COORDINATES FOR LEFT SIDE
C
 400   CONTINUE
      IF(S(ILOW-1),EQ,0.0)GO TO  401
      XLT = X(ILOW) + (YSUR-Y(ILOW))/S(ILOW-1)
      GO TO 402
 401  XLT = X(ILOW)
 402  YLT = YSUR
C        CALCULATE NEW COORDINATES FOR RIGHT SIDE
      IF(S(IHI),EQ,0,0) GO TO 410
      XRT = X(IHI) + (YSUR-Y(IHI))/S(IHI)
      GO TO 411
 410  XRT = X(IHI)
 411  YRT = YSUR
C
C        FIND AREA FOR DEPTH
      ALT = 0,5*(X(ILOW)-XLT)*(YLT-Y(ILOW))
      ART = 0,5*(XRT-X(IHI))*(YRT-Y(IHI))
      ATOT = ALT + ART
C     CHECK FOR V-NOTCH CHANNEL
      IF(ILOW,EQ,IHI) GO TO 600
      IM = IHI - 1
      DO 500 J= ILOW,IM
      A(J) = 0,5*((YSUR-Y(J))+(YSUR-Y(J+1)))*(X(J+1)-X(J))
 500  ATOT = ATOT + A(J)
 600  IF(ABS(ATOT-AREA),LT,,00001) GO TO 700
      YDEL = (ATOT-AREA)/(XRT-XLT)
C        IF THIS STATEMENT REACHED PROPER DEPTH NOT FOUND YET, TRY AGAIN
      YCHAN = YCHAN - YDEL
      GO TO 250
C        WHEN STATEMENT 700 IS REACHED,DEPTH HAS BEEN FOUND,
C        NOW CALCULATE WETTED PERIMETER
 700  WPLT = SQRT(((X(ILOW)-XLT)**2) + ((YLT-Y(ILOW))**2))
      WPRT = SQRT(((XRT-X(IHI))**2)+ ((YRT-Y(IHI))**2))
C
C        NOW CALCULATE AREA, WETTED PERIMETER AND HYDRAULIC RADIUS FOR
C        EACH OVERBANK AND MAIN CHANNEL
C
C        FIRST IS LEFT OVERBANK IF ONE EXISTS
 702  ALOB = 0,0
      WPLOB = 0,0
      HRLOB = 0,0
      JJ=ILOW
      IF(XLOB,EQ,0.0,OR,XLOB,LE,XLT) GO TO 705
      ALOB = ALT
      WPLOB = WPLT
      DO 703 J = ILOW,IM
      IF(XLOB,LT,X(J+1))  GO TO 704
      ALOB = ALOB + A(J)
      WPLOB = WPLOB + SQRT(((X(J+1)-X(J))**2) + ((Y(J+1)-Y(J))**2))
 703  JJ = J + 1
      STOP 703
 704  HRLOB = ALOB/WPLOB
C        NOW FIND INFO ON MAIN CHANNEL
 705  AMID = 0,0
      WPMID = 0,0
      HRMID = 0,0
      IF(ALOB,NE,0,0) GO TO 707
      AMID = ALT
      WPMID = WPLT
 707  DO 709 J = JJ,IM
      IF(XROB,LT,X(J+1),AND,XROB,NE,0,0) GO TO 711
      IF(X(J+1),GT,XRT) GO TO 710
      AMID = AMID + A(J)
      WPMID = WPMID + SQRT(((X(J+1)-X(J))**2) + ((Y(J+1)-Y(J))**2))
 709  JJ = J +1
      IF(XRT,GT,XROB,AND,XROB,NE,0.0)GO TO 711
 710  AMID = AMID + ART
      WPMID = WPMID + WPRT
C        CALCULATE CORRECTION FACTOR FOR WETTED PERIMETER
 711  WPCOR = 0,0
      DO 712 J = 1,NOCO
      IF(X(J),EQ,XLOB,AND,Y(J),LT,YSUR) WPCOR = WPCOR + (YSUR - Y(J))
      IF(X(J),EQ,XROB,AND,Y(J),LT,YSUR) WPCOR = WPCOR + (YSUR - Y(J))
 712  CONTINUE
      WPMID = WPMID + WPCOR
      HRMID = AMID/WPMID
C        NOW START RIGHT OVERBANK CALCULATIONS
      AROB = 0,0
      WPROB = 0,0
      HRROB = 0,0
      IF(XROB,EQ,0,0,OR,XROB,GE,XRT) GO TO 717
      AROB = ART
      WPROB = WPRT
      DO 715 J= JJ,IM
      IF(X(J+1),GT,XRT) GO TO 716
      AROB = AROB + A(J)
 715  WPROB = WPROB + SQRT(((X(J+1)-X(J))**2) + ((Y(J+1)-Y(J))**2))
C
 716  HRROB = AROB/WPROB
C
C        NOW DO A DOUBLE CHECK TO MAKE SURE AREA IS CORRECT
C
 717  IF(ABS(AREA-(ALOB+AMID+AROB)).GT,0,0001)
     1   WRITE(IOUT,718) AREA, ALOB,AMID,AROB
 718  FORMAT(1X,'AREA = ',F10,4, 5X,'ALOB = ',F10,4,5X,'AMID = ',F10,4,
     1   5X,'AROB = ',F10,4)
C
C
C        FOR EQUIVALENT 'N' VALUES
      EQUIVN = 0,0
      IF(RN(1),NE,0.0) EQUIVN = (WPLOB*HRLOB**1,6667)/RN(1)
      EQUIVN = (WPMID*HRMID**1,6667)/RN(2) + EQUIVN
      IF(RN(3),NE,0.0)  EQUIVN = (WPROB*HRROB**1,6667)/RN(3) + EQUIVN
      WP = (WPLOB + WPMID - WPCOR + WPROB)
      EQUIVN = (WP*((ALOB+AMID+AROB)/WP)**1,6667)/EQUIVN
C
C        NOW DETERMINE FLOW
      QLOB = 0,0
      QROB = 0,0
      QMID = 0,0
      IF(RN(1),NE,0.0) QLOB=(HRLOB**(2,/3,)) * ALOB /RN(1)
      IF(RN(2),NE,0.0) QMID=(HRMID**(2,/3,)) * AMID /RN(2)
      IF(RN(3),NE,0.0) QROB=(HRROB**(2,/3,)) * AROB /RN(3)
      QCAL = QLOB + QMID + QROB
C        ON FIRST PASS          AFULL,QFULL,DFULL ARE CALCULATED
```

```
      IF(K,NE,NSEC+1) GO TO 850
      DFULL = YMAX - YLOW
      AFACT(NT) = AFULL/(DFULL**2)
      RFACT(NT) = ((ALOB+AMID+AROB)/WP)/DFULL
      QFULL = QCAL
      ALFMAX(NT) = 1,0
      PSIMAX(NT) = 1,0
 850  IF(K,NE,1) GO TO 875
      QNORM(NT,1) = 0,0
      ANORM(NT,1) = 0,0
      DNORM(NT,1) = 0,0
      RUFN(NT-15,1) = RUFN(NT-15,2)
      GO TO 240
 875  QNORM(NT,K)  =QCAL / QFULL
      ANORM(NT,K)  =AREA / AFULL
      DNORM(NT,K)  =(YSUR-YLOW)/DFULL
      RUFN(NT-15,K)  = EQUIVN
      GO TO 240
C
C         PLACE TEMPORARY WRITE ROUTINE HERE.
C
 1000 NT = NT -1
      WRITE(IOUT,950)
 950  FORMAT(1H1,30X,35H OUTPUT FOR NATURAL SECTION ROUTINE ,10X,
     1       17H VERSION  7/29/75,//,45X,2HBY,//,35X,
     2       25H ESPEY,HUSTON AND ASSOC, ,///)
      WRITE(IOUT,970)
  970 FORMAT ('0NTYPE  DESCRIPTION      ALFMAX  PSIMAX  AFACT   RFACT  K
     1DEPTH  KLASS  INDEX  ANORM   QNORM    DNORM    RUFN')
      DO 1100 L=16,NT
      L2=L-15
      MMM = MM(L)
      IF (MM(L),LT,NN(L)) MMM = NN(L)
      RUF(L2) = RUFN(L2,MMM)
 1100 WRITE (6,971) L,(NAME(J,L),J=1,4),ALFMAX(L) ,PSIMAX(L) ,AFACT(L) ,
     1 RFACT(L) ,KDEPTH(L),KLASS(L),(J,ANORM(L ,J),QNORM(L ,J),
     2    DNORM(L ,J),RUFN(L2,J),J=1,MMM)
  971 FORMAT (I4,4X,4A4,F7,4,3F8,4,I5,I7,I8,F8,3,3F9,5,/(67X,I8,F8,3,
     1 3F9,5))
 5000  RETURN
      END
*DECK,SLOP
      SUBROUTINE SLOP
C=======================================================================
C     ROUTINE TO SEQUENCE ELEMENTS FOR COMPUTATION,
C     THIS VERSION OF SLOP USES VECTOR 'NIN' TO POINT TO INTERNAL NUMBER
C     EXTERNAL ELEMENT NUMBERS MUST BE NUMERIC AND LE 1000,
C****    COMMON AREAS           TABLES HAVE BEEN DELETED FROM THIS
C****    ROUTINE SINCE THEY WERE NOT BEING USED BY THIS ROUTINE
C****    DONE BY TS OF EH%A ON  1/25/76      ************************
      COMMON /NAMES/ NAME(4,35),GNO,YES,BLANK
      COMMON A(160,2,2),Q(160,2,2),CPOL1(160,2,5),CPOL2(160,2,5),QMAX(16
     10),    QFULL(160), AFULL(160), DXDT(160),C1(160), SLOPE(160),
     2        DIST(160), GEOM1(160), ROUGH(160), NOE(160), NUE(160,3),
     3        INUE(160,3), NTYPE(160), JR(160), NKLASS, NE, NDT, EPSIL,
     4        TIME, DT, M, KFULL, N, NOS, NPOLL, NPRINT, ITER,
     5        QDWF(160), IOLD(160), P1(160), RNOFF(160), QINFIL(160),
     6        WDWF(160,5), PLUTO(160,5), IR(160), P2(160), NIN(1000),
     7        P5(160),P6(160),P7(160),SCF(160),BARREL(160),
     8        TITLE(40), NPE(20), NYN(20), NORDER(70), GEOM2(160),
     9        GEOM3(160) , P4(160),SCOUR(160), KSTORE(160)
      COMMON  BODIN( 2,150),SSIN( 2,150),BODOUT,SSOUT,COLIN(2,150),
     *  QINST,QOUST,QINSTL( 2),QOUSTL( 2),STORL( 2),QOUTO( 2),STORO( 2),
     *  NSTOR,KSTOR,IPRINT( 2),IPOL( 2),IFLOOD( 2),ICOST( 2),DEPMAX( 2),
     *  ATERM( 2,11),AO2DT2( 2,11),BDEPTH( 2,11),BSTOR( 2,11),COLOUT,
     *  DUMSTR(11),DUMDEP(11),
     *  KTSTEP,VOLIN( 2,150),VOLOUT( 2,150),STOR,CUMIN( 2),CUMOUT( 2),
     *  SBOD( 2),SSS( 2),SCOL( 2),
     *  ISTMOD( 2),ISTTYP( 2),ISTOUT( 2),
     *  QPUMP( 2),DSTART( 2),DSTOP( 2),
     *  DTON( 2),STORMX( 2),DTPUMP( 2),DTMORE( 2),STORF( 2),APLAN( 2),
     *  CLAND( 2),CSTOR( 2),CPS( 2),CTOTAL( 2),CPCUYD( 2),CPACRE( 2),
     *  LP,JP,LPREV( 2),LABEL,DETENT(150),FRAC(150),OUT1(10,200)
      NEP1 = NE+1
C     ZERO OUT ARRAYS
      DO 10 I=1,NE
      IR(I) = 0
   10 JR(I) = 0
C     COMPUTE INTERNAL UPSTREAM ELEMENT NUMBERS.
      DO 15 N=1,NE
      DO 15 J=1,3
      IF (NUE(N,J)) 12,12,13
C     IF THERE IS NO UPSTREAM ELEMENT, ASSIGN ARTIFICIAL VALUE.
   12 INUE(N,J) = NEP1
      GO TO 15
   13 L = NUE(N,J)
C     UPSTREAM ELEMENT NUMBERS NOW FOUND FROM POINTING VECTOR, 'NIN'.
      INUE(N,J) = NIN(L)
   15 CONTINUE
C     SEQUENCE ELEMENTS FOR COMPUTATION.
C     FLOW MAY BE ROUTED IN ELEMENT I IF IT HAS BEEN ROUTED IN ALL
C        UPSTREAM ELEMENTS.
      DO 30 N=1,NE
      I = 1
   17 IF(IR(I)) 20,20,18
   18 I = I+1
      IF (I-NE) 17,17,30
   20 DO 25 J=1,3
      IF (NUE(I,J)) 25,25,22
   22 L = INUE(I,J)
      IF (IR(L)) 18,18,25
   25 CONTINUE
      IR(I) = 1
      JR(N) = 1
   30 CONTINUE
      WRITE (6,901) NEP1
  901 FORMAT(/,' * * * * *  ELEMENT LINKAGES AND COMPUTATION SEQUENCE  *
     1 * * * *',//,' ELEMENT NO. ZERO IS GIVEN INTERNAL NO. = NO. ELEMEN
     2TS + 1 =',I4)
      WRITE (6,905)
  905 FORMAT('0EXTERNAL INTERNAL TYPE  DESCRIPTION     UPSTREAM ELEMENTS
     1'7X,'ORDER OF COMPUTATIONS AT EACH TIME STEP (PROCEEDING DOWNSTREA
     2M)'/' ELEMENT  ELEMENT'25X,'(EXTERNAL NOS.)'18X,'COMPUTATION  EXTE
     3RNAL INTERNAL  INTERNAL UPSTREAM'/' NUMBER   NUMBER'29X'1    2
     43'19X,'SEQUENCE     NUMBER   NUMBER    ELEMENT NUMBERS',/)
      DO 50 I=1,NE
      L = JR(I)
      NT = NTYPE(I)
   50 WRITE (6,906) NOE(I),I,NT,(NAME(J,NT),J=1,4),(NUE(I,J),J=1,3),I,
     1 NOE(L),L,(INUE(L,J),J=1,3)
  906 FORMAT (I6,I9,I7,3X,4A4,3I5,19X,I5,I13,I9,4X,3I5)
      RETURN
      END
*DECK,FIRST
      SUBROUTINE FIRST(MI,KATHY)
C=====================================================================
C     ROUTINE PERFORMS INITIAL CALCULATIONS FOR EACH SEWER ELEMENT.
C     KATHY=0, FIRST IS BEING CALLED AT BEGINNING OF PROGRAM.
C     KATHY=1, FIRST IS BEING CALLED FOR A SINGLE ELEMENT, MI.
C     KATHY=2, FIRST IS BEING CALLED AT END OF PROGRAM.
      DIMENSION QI(160),QO(160),WELL2(160),QO1(160),QO2(160),PUMP(160)
     1    , SURGE1(160),SURGE2(160)
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      COMMON/TABLES/ KDEPTH(35),KLASS(35),PSIMAX(25),ALFMAX(25),NN(35),
     1               MM(35),ANORM(25,51),QNORM(25,51),DNORM(25,51),
     2  AFACT(25),  RFACT(25)
      COMMON /NAMES/ NAME(4,35),GNO,YES,BLANK
      COMMON A(160,2,2),Q(160,2,2),CPOL1(160,2,5),CPOL2(160,2,5),QMAX(16FIRS 13
     10),     QFULL(160), AFULL(160), DXDT(160),C1(160), SLOPE(160),    FIRS 14
     2        DIST(160), GEOM1(160), ROUGH(160), NOE(160), NUE(160,3),  FIRS 15
     3        INUE(160,3), NTYPE(160), JR(160), NKLASS, NE, NDT, EPSIL, FIRS 16
     4        TIME, DT, M, KFULL, N, NDS, NPOLL, NPRINT, ITER,          FIRS 17
     5        QDWF(160), IOLD(160), P1(160), RNOFF(160), QINFIL(160),   FIRS 18
     6        WDWF(160,5), PLUTO(160,5), IR(160), P2(160), NIN(1000),   FIRS 19
     7        P5(160),P6(160),P7(160),SCF(160),BARREL(160),             FIRS 20
     8        TITLE(40), NPE(20), NYN(20), NORDER(70), GEOM2(160),      FIRS 21
     9        GEOM3(160) , P4(160),SCOUR(160), KSTORE(160)              FIRS 22
      EQUIVALENCE (QO(1),Q(1,2,2)),(QI(1),Q(1,1,2))                     FIRS 23
      EQUIVALENCE (WELL2(1),ROUGH(1))                                   FIRS 24
      EQUIVALENCE (QO1(1),QMAX(1)),(QO2(1),QFULL(1))                    FIRS 25
      EQUIVALENCE (PUMP(1),DIST(1)),(SURGE1(1),P1(1)),(SURGE2(1),P2(1)) FIRS 26
C     CALCULATE AREAS AND MAX, FLOWS USING MANNING EQN, AND GEOMETRY,   FIRS 27
C     ALSO CALCULATE CERTAIN PARAMETERS USED IN ROUTING COMPUTATIONS,   FIRS 28
C     NTYPE=1 DENOTES CIRCULAR CONDUIT,                                 FIRS 29
C     NTYPE=2 DENOTES RECTANGULAR CONDUIT,                              FIRS 30
C     NTYPE=3 DENOTES PHILLIPS STANDARD EGG-SHAPED CONDUIT,             FIRS 31
C     NTYPE=4 DENOTES BOSTON HORSESHOE CONDUIT,                         FIRS 32
C     NTYPE=5 DENOTES GOTHIC CONDUIT,                                   FIRS 33
C     NTYPE=6 DENOTES CATENARY CONDUIT,                                 FIRS 34
C     NTYPE=7 DENOTES LOUISVILLE SEMI-ELLIPTIC CONDUIT,                 FIRS 35
C     NTYPE=8 DENOTES BASKET-HANDLE CONDUIT,                            FIRS 36
C     NTYPE=9 DENOTES SEMI-CIRCULAR CONDUIT,                            FIRS 37
C     NTYPE=10 DENOTES MODIFIED BASKET-HANDLE CONDUIT,                  FIRS 38
C     NTYPE=11 DENOTES RECTANGULAR CONDUIT, TRIANGULAR BOTTOM,          FIRS 39
C     NTYPE=12 DENOTES RECTANGULAR CONDUIT, ROUND BOTTOM,               FIRS 40
C     NTYPE=13 DENOTES TRAPEZOIDAL CHANNEL,                             FIRS 41
C     NTYPE=14,15 ARE USER SUPPLIED CONDUIT SHAPES,                     FIRS 42
C     NTYPE=16 THRU 25 DENOTES USER SUPPLIED NATURAL SECTION
C     NTYPE=26 DENOTES MANHOLE,                                         FIRS 43
C     NTYPE=27 DENOTES LIFT STATION,                                    FIRS 44
C     NTYPE=28 DENOTES TYPE 28 FLOW DIVIDER,                            FIRS 45
C     NTYPE=29 DENOTES STORAGE UNIT,                                    FIRS 46
C     NTYPE=30 DENOTES TYPE 30 FLOW DIVIDER,                            FIRS 47
C     NTYPE=31 DENOTES TYPE 31 FLOW DIVIDER,                            FIRS 48
C     NTYPE=32 DENOTES BACKWATER ELEMENT,                               FIRS 49
C     NTYPE=33,34,35 ARE NOT YET PROGRAMMED,                            FIRS 50
      K = 0                                                             FIRS 51
      IF(KATHY,EQ,1) MSAVE=M                                            FIRS 52
      DO 200 IM=1,NE                                                    FIRS 53
      M=IM                                                              FIRS 54
      IF(KATHY,EQ,1) M=MI                                               FIRS 55
      NT = NTYPE(M)                                                     FIRS 56
C****    NEXT CARD CHANGED BY TS OF EH%A ON  1/25/76        *************
      GO TO (10,20,10,10,10,10,10,10,10,100,110,120,130,10,10,10,10,10, FIRS 57
C****    NEXT CARD CHANGED BY TS OF EH%A ON  1/25/76        *************
     1 10,10,10,10,10,10,10,190,160,                                    FIRS 58
C****    NEXT CARD ADDED BY TS OF EH%A ON  1/25/76          *************
     2 190,190,190,170,190,190,190),NT                                  FIRS 58A
C     CALCULATIONS FOR SHAPES DESCRIBED BY TABULAR Q-A RELATIONSHIPS,   FIRS 59
C     GEOM1(M)=MAXIMUM VERTICAL DIMENSION FOR THESE SHAPES,             FIRS 60
C     UNITS OF FEET AND SECONDS ARE USED THROUGHOUT,                    FIRS 61
   10 AFULL(M) = AFACT(NT)*GEOM1(M)*GEOM1(M)                            FIRS 62
      P1(M) = 1,49/ROUGH(M)*AFULL(M)*(RFACT(NT)*GEOM1(M))**0,6666667    FIRS 63
      P2(M) = GEOM1(M)/DIST(M)                                          FIRS 64
      P4(M) = PSIMAX(NT)                                                FIRS 65
      GO TO 150                                                         FIRS 66
C     CALCULATIONS FOR RECTANGULAR CONDUIT,                             FIRS 67
   20 AFULL(M) = GEOM1(M)*GEOM2(M)                                      FIRS 68
      RH = AFULL(M)/(2.0*(GEOM1(M)+GEOM2(M)))                           FIRS 69
      P1(M) = 1,49/ROUGH(M)*AFULL(M)*RH**0,6666667
      P5(M) = GEOM1(M)/GEOM2(M)
      P6(M) = -1,333333*P5(M)
      P7(M) = 2,0*P5(M)+2,0
      P2(M) = GEOM1(M)/DIST(M)
      P4(M) = PSI(ALFMAX(NT))
      GO TO 150
C     CALCULATIONS FOR MODIFIED BASKET-HANDLE CONDUIT,
  100 GEOM3(M) = GEOM1(M)*GEOM2(M)
      P5(M) = 0,7853982*GEOM2(M)*GEOM2(M)
      AFULL(M) = GEOM3(M)+P5(M)/2,0
      RH = AFULL(M)/(GEOM2(M)*2,570796 +2,0*GEOM1(M))
      P1(M) = 1,49/ROUGH(M)*AFULL(M)*RH**0,6666667
      RH = GEOM3(M)/(2,0*(GEOM1(M)+GEOM2(M)))
      P6(M) = 1,49/ROUGH(M)*GEOM3(M)*RH**0,6666667/P1(M)
      ALM = (GEOM3(M)+P5(M)*(ALFMAX(1)-0,5))/AFULL(M)
      P7(M) = 2,0*GEOM1(M)/GEOM2(M)+2,0
      P2(M) = (GEOM1(M)+GEOM2(M)/2,0)/DIST(M)
      P4(M) = PSI(ALM)
      GO TO 150
C     CALCULATIONS FOR RECTANGULAR CONDUIT, TRIANGULAR BOTTOM,
  110 AFULL(M) = GEOM2(M)*(GEOM1(M)-GEOM3(M)/2,0)
      P5(M) = 0,5*SIN(ATAN(2.0*GEOM3(M)/GEOM2(M)))
      P6(M) = GEOM3(M)/P5(M)+2,0*(GEOM1(M)-GEOM3(M))+GEOM2(M)
      RH = P5(M)/SQRT(2,0*GEOM3(M)/GEOM2(M))*P6(M)
      P7(M) = RH**0,6666667/AFULL(M)**0,3333333
      P1(M) = 1,49/ROUGH(M)*AFULL(M)*(AFULL(M)/P6(M))**0,6666667
      P2(M) = GEOM1(M)/DIST(M)
      P4(M) = PSI(ALFMAX(NT))
      GO TO 150
C     CALCULATIONS FOR RECTANGULAR CONDUIT, ROUND BOTTOM,
  120 P5(M) = 2,0*ARSIN(GEOM2(M)/2,0/GEOM3(M))
      P6(M) = GEOM3(M)*GEOM3(M)/2,0*(P5(M)-SIN(P5(M)))
      AFULL(M) = GEOM2(M)*GEOM1(M)+P6(M)
      RH = AFULL(M)/(GEOM3(M)*P5(M)+2,0*GEOM1(M)+GEOM2(M))
      P1(M) = 1,49/ROUGH(M)*AFULL(M)*RH**0,6666667
      AA = 3,1415965*GEOM3(M)*GEOM3(M)
      P7(M) = 1,49/ROUGH(M)*AA*(GEOM3(M)/2,0)**0,6666667/P1(M)
      P2(M) = (GEOM1(M)+GEOM3(M)*(1,0-COS(P5(M)/2,0)))/DIST(M)
      P4(M) = PSI(ALFMAX(NT))
      GO TO 150
C    CALCULATIONS FOR TRAPEZOIDAL CHANNEL
  130 AFULL(M) = GEOM1(M) * (GEOM2(M) + GEOM1(M)/GEOM3(M))
      P5(M) = 2,0/SIN(ATAN(GEOM3(M)))
      P6(M) = AFULL(M)/(GEOM2(M) + P5(M) * GEOM1(M))
      P7(M) = (GEOM2(M) * GEOM3(M))**2/4,0
      P1(M) = 1,49/ROUGH(M) * AFULL(M) * P6(M)**0,6666667
      P2(M) = GEOM1(M)/DIST(M)
      P4(M) = 1,0
C     CALCULATIONS COMMON TO ALL CONDUITS,
C     CONVERT SLOPE FROM FT,/100 FT, TO FT,/FT,
  150 IF(KATHY,NE,0) GO TO 152
      SLOPE(M)=SLOPE(M)*0,01
      DXDT(M) = DIST(M)/DT
  152 QFULL(M)=P1(M)*SQRT(SLOPE(M))
      QMAX(M) = P4(M)*QFULL(M)
      C1(M) = DXDT(M)*AFULL(M)/QFULL(M)
C     DETERMINE IF FLOW IN CONDUIT IS SUPER-CRITICAL MOST OF TIME,
C     CRITERION IS DERIVED BY COMPARING NORMAL AND CRITICAL VELOCITIES,
C     BOTH VELOCITIES DEPEND UPON DEPTH OF FLOW,
C     FACTOR OF 0,3 CORRESPONDS TO CIRCULAR PIPE 95( FULL,
      AA=1,49/ROUGH(M)*SQRT(SLOPE(M)/32,2)*(P2(M)*DIST(M))**,1666667*0.3
      SCF(M) = GNO
      IF (AA,GE,1,0) SCF(M) = YES
      IF(KATHY,NE,1) GO TO 200
      M=MSAVE
      RETURN
C     CALCULATIONS FOR LIFT STATION.
C     INITIAL VOLUME IN WET WELL IS HALF THE CAPACITY.
  160 WELL2(M) = 0.5*GEOM1(M)
      GO TO 190
C     DETERMINE NUMBER AND ELEMENT NUMBERS OF FLOW DIVIDER TYPE 21'S.
  170 K = K+1
      IR(K) = M
      GO TO 190
C     INITIALIZE SURCHARGE VOLUME IN NON-CONDUITS.
  190 SURGE1(M) = 0.0
      SURGE2(M) = 0.0
      SCF(M) = BLANK
  200 CONTINUE
      IF (K.EQ.0) RETURN
C     INITIALIZE FLOW SETTING FOR TYPE 21 FLOW DIVIDERS.
      DO 220 I=1,K
      M= IR(I)
      L=GEOM3(M)
      L=NIN(L)
  220 GEOM1(M)=(QFULL(L)/2.0)*BARREL(L)
      RETURN
      END
*DECK,DWLOAD
      SUBROUTINE DWLOAD(DWDAYS)
C=====================================================================
C     THIS SUBROUTINE SETS UP INITIAL CONDITIONS OF SEDIMENTATION
C     BASED UPON  'DWDAYS' OF DRY WEATHER FLOW PRIOR TO THE STORM
      DIMENSION QI(160),QO(160),QO1(160),QO2(160)
      COMMON/DRWF/ DVDWF(7),DVBOD(7),DVSS(7),HVDWF(24),HVBOD(24),
     1             HVSS(24),HVCOLI(24),KTNUM,KDAY,KHOUR,KMINS
      COMMON/TABLES/ KDEPTH(35),KLASS(35),PSIMAX(25),ALFMAX(25),NN(35),
     1              MM(35),ANORM(25,51),QNORM(25,51),DNORM(25,51),
     2   AFACT(25),  RFACT(25)
      COMMON A(160,2,2),Q(160,2,2),CPOL1(160,2,5),CPOL2(160,2,5),QMAX(16
     10),    QFULL(160), AFULL(160), DXDT(160),C1(160), SLOPE(160),
     2       DIST(160), GEOM1(160), ROUGH(160), NOE(160), NUE(160,3),
     3       INUE(160,3), NTYPE(160), JR(160), NKLASS, NE, NDT, EPSIL,
     4       TIME, DT, M, KFULL, N, NOS, NPOLL, NPRINT, ITER,
     5       QDWF(160), IOLD(160), P1(160), RNOFF(160), QINFIL(160),
     6       WDWF(160,5), PLUTO(160,5), IR(160), P2(160), NIN(1000),
     7       P5(160),P6(160),P7(160),SCF(160),BARREL(160),
     8       TITLE(40), NPE(20), NYN(20), NORDER(70), GEOM2(160),
     9       GEOM3(160) , P4(160),SCOUR(160), KSTORE(160)
      COMMON  BODIN( 2,150),SSIN( 2,150),BODOUT,SSOUT,COLIN(2,150),
     * QINST,QOUST,QINSTL( 2),QOUSTL( 2),STORL( 2),QOUTO( 2),STORO( 2),
     * NSTOR,KSTOR,IPRINT( 2),IPOL( 2),IFLOOD( 2),ICOST( 2),DEPMAX( 2),
     * ATERM( 2,11),AO2DT2( 2,11),BDEPTH( 2,11),BSTOR( 2,11),COLOUT,
     * DUMSTR(11),DUMDEP(11),
     * KTSTEP,VOLIN( 2,150),VOLOUT( 2,150),STOR,CUMIN( 2),CUMOUT( 2),
     * SBOD( 2),SSS( 2),SCOL( 2),
     * ISTMOD( 2),ISTTYP( 2),ISTOUT( 2),
     * QPUMP( 2),DSTART( 2),DSTOP( 2),
     * DTON( 2),STORMX( 2),DTPUMP( 2),DTMORE( 2),STORF( 2),APLAN( 2),
     * CLAND( 2),CSTOR( 2),CPS( 2),CTOTAL( 2),CPCUYD( 2),CPACRE( 2),
     * LP,JP,LPREV( 2),LABEL,DETENT(150),FRAC(150),OUT1(10,200)
      EQUIVALENCE (QO1(1),QMAX(1)),(QO2(1),QFULL(1))
      EQUIVALENCE (QO(1),Q(1,2,2)),(QI(1),Q(1,1,2))
      REAL KVAL
      DO 10 IK=1,NE
   10 SCOUR(IK)=0.0
C     BEGIN DO LOOP ON HOUR OF DAY
      DO 200 KJ=1,24
C     MODEL DWF FOR AN HOUR
C     START WITH EMPTY SEWER EACH HOUR(EXCEPT FOR ANY DEPOSITION FROM
C     PREVIOUS HOUR
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      DO 5 IK=1,NE                                                      DWLO 43
      Q(IK,1,1)=0,0                                                     DWLO 44
      Q(IK,2,1)=0,0                                                     DWLO 45
      CPOL1(IK,1,2) = 0,0                                               DWLO 46
      CPOL2(IK,1,2) = 0,0                                               DWLO 47
    5 CONTINUE                                                          DWLO 48
      DO 100 I=1,NE                                                     DWLO 49
      M=JR(I)                                                           DWLO 50
      SUM1=0,0                                                          DWLO 51
      SUM2=0,0                                                          DWLO 52
C     ADD UP UPSTREAM FLOWS AND CONVERT LOADS TO LBS/SEC                DWLO 53
      DO 20 J=1,3                                                       DWLO 54
      L=INUE(M,J)                                                       DWLO 55
      NTU=NTYPE(L)                                                      DWLO 56
C****    NEXT CARD CHANGED BY TS OF EH%A ON  1/25/76        *************
      IF(NTU,LE,27,OR,NTU,GE,33) GO TO 18                               DWLO 57
      KK=GEOM3(L)                                                       DWLO 58
      QQ=QO2(L)                                                         DWLO 59
      IF(NOE(M),EQ,KK) QQ=QO1(L)                                        DWLO 60
      GO TO 19                                                          DWLO 61
   18 QQ=Q(L,2,1)*BARREL(L)                                             DWLO 62
   19 SUM1=SUM1+QQ                                                      DWLO 63
   20 SUM2=SUM2+CPOL2(L,1,2) * QQ                                       DWLO 64
C     ADD DWF AND INFILTRATION FOR THIS HOUR                            DWLO 65
      SUM1=SUM1+QDWF(M)*HVDWF(KJ)      + QINFIL(M)                      DWLO 66
      SUM2=SUM2+WDWF(M,2)*HVSS(KJ)*HVDWF(KJ)                            DWLO 67
      Q(M,1,1)=SUM1/BARREL(M)                                           DWLO 68
      Q(M,2,1)=Q(M,1,1)                                                 DWLO 69
C     CALCULATE LOADS IN LBS/CF                                         DWLO 70
      IF(SUM1,LE,0,0) GO TO 100                                         DWLO 71
      CPOL1(M,1,2)  = SUM2/SUM1                                         DWLO 72
      CPOL2(M,1,2)  =SUM2/SUM1                                          DWLO 73
      NT=NTYPE(M)                                                       DWLO 74
C****    NEXT CARD CHANGED BY TS OF EH%A ON  1/25/76        *************
      IF (NT,EQ,32) GO TO 28                                            DWLO 75
C****    NEXT CARD CHANGED BY TS OF EH%A ON  1/25/76        *************
      IF(NT,LT,28,OR,NT,GT,32) GO TO 30                                 DWLO 76
C     IN A FLOW DIVIDER TYPE ELEMENT, ASSUME ALL DWF IS NOT DIVERTED,   DWLO 77
      QO1(M)=SUM1                                                       DWLO 78
      QO2(M)=0,0                                                        DWLO 79
      GO TO 30                                                          DWLO 80
   28 QO1(M) = 0,0                                                      DWLO 81
      QO2(M) = SUM1                                                     DWLO 82
C     IF A NON-CONDUIT DO NOT CALCULATE ANY DEPOSITION                  DWLO 83
   30 IF(KLASS(NT),EQ,3) GO TO 100                                      DWLO 84
C     ASSUME UNIFORM AREA OF FLOW THROUGHOUT ELEMENT                    DWLO 85
      PS=Q(M,1,1)/QFULL(M)                                              DWLO 86
      CALL FINDA(PS,A(M,1,1))                                           DWLO 87
C     FIND HYDRAULIC RADIUS GIVEN THE FLOW AREA,                        DWLO 88
      AREAF=A(M,1,1)                                                    DWLO 89
      RHYD=RADH(AREAF)                                                  DWLO 90
C     DETERMINE AMOUNT OF DEPOSITION AND SCOUR                          DWLO 91
      SPG=2,7                                                           DWLO 92
      KVAL=,056                                                         DWLO 93
C     FIND THE CRITICAL DIAMETER FOR MOTION OF SOLIDS,                  DWLO 94
      CRITD=RHYD*SLOPE(M)/(KVAL*(SPG-1,0))                              DWLO 95
      CRITD=CRITD*304,8                                                 DWLO 96
      IF(CRITD,LE,,59) PCT1=-1,2471*CRITD+1,0                           DWLO 97
      IF(CRITD,GT,,59,AND,CRITD,LE,2,0) PCT1=-,1501*CRITD+,3527         DWLO 98
      IF(CRITD,GT,2,0,AND,CRITD,LE,10,0) PCT1=-,00656*CRITD+,0656       DWLO 99
      IF(CRITD,GT,10,0) PCT1=0,0                                        DWLO100
      IF(CRITD,LE,0,0) PCT1=1,0                                         DWLO101
      PCT2=PCT1                                                         DWLO102
      SCOUR(M)=SCOUR(M)+PCT2*SUM2*3600,                                 DWLO103
      SUM3=(1,0-PCT2)*SUM2+(1,0-PCT1)*SCOUR(M)/3600,                    DWLO104
      CPOL1(M,1,2)  = SUM3 /SUM1                                        DWLO105
      CPOL2(M,1,2)  = CPOL1(M,1,2)                                      DWL0106
      SCOUR(M)=PCT1*SCOUR(M)                                            DWL0107
  100 CONTINUE                                                          DWL0108
  200 CONTINUE                                                          DWL0109
C     ASSUME SAME BED LOAD ACCUMULATION FOR EACH DWDAY                  DWL0110
      DO 210 I=1,NE                                                     DWL0111
      M=JR(I)                                                           DWL0112
      SCOUR(M)=DWDAYS*SCOUR(M)                                          DWL0113
C     SET UPPER LIMIT OF BED LOAD AS HALF OF PIPE VOLUME                DWL0114
C     THE NUMBER 84,28=2,7*62,4/2,0                                     DWL0115
      ULIMIT=84,28*AFULL(M)*DIST(M)*BARREL(M)                           DWL0116
      IF(SCOUR(M),GT,ULIMIT) SCOUR(M)=ULIMIT                            DWL0117
  210 CONTINUE                                                          DWL0118
C     PRINT OUT INITIAL DWLOAD CONDITIONS                               DWL0119
      WRITE(6,900) DWDAYS                                               DWL0120
      WRITE(6,910)                                                      DWL0121
      DO 220 I=1,NE                                                     DWL0122
      M=JR(I)                                                           DWL0123
      NT=NTYPE(M)                                                       DWL0124
      IF(KLASS(NT),GT,2) GO TO 220                                      DWL0125
      WRITE(6,920) NOE(M),SCOUR(M)                                      DWL0126
  220 CONTINUE                                                          DWL0127
  900 FORMAT('1',28X,'INITIAL BED OF SOLIDS (LBS) IN SEWER DUE TO'/,    DWL0128
     130X,F5,1,' DAYS OF DRY WEATHER PRIOR TO STORM '///)               DWL0129
  910 FORMAT(' ',31X,'ELEMENT',20X,'SOLIDS IN',/,32X,'NUMBER',23X,'BOTTODWL0130
     1M'/,62X,'(LBS)'///)                                               DWL0131
  920 FORMAT(' ',30X,I6,20X,F10,5)                                      DWL0132
      RETURN                                                            DWL0133
      END                                                               DWL0134
*DECK,INITAL
      SUBROUTINE INITAL                                                 INIT  1
C=====================================================================INIT  2
C     ROUTINE INITIALIZES FLOWS, AREAS, AND CONCENTRATIONS TO VALUES    INIT  3
C         CORRESPONDING TO DRY WEATHER FLOW PLUS INFILTRATION,          INIT  4
C     WHEN THERE ARE NO INITIAL VALUES OF DWF OR INFIL, VALUES REMAIN 0,INIT  5
      COMMON/TABLES/ KDEPTH(35),KLASS(35),PSIMAX(25),ALFMAX(25),NN(35),
     1               MM(35),ANORM(25,51),QNORM(25,51),DNORM(25,51),
     2   AFACT(25),  RFACT(25)
      COMMON/DRWF/ DVDWF(7),DVBOD(7),DVSS(7),HVDWF(24),HVBOD(24),       INIT  9
     1             HVSS(24),HVCOLI(24),KTNUM,KDAY,KHOUR,KMINS           INIT 10
      COMMON A(160,2,2),Q(160,2,2),CPOL1(160,2,5),CPOL2(160,2,5),QMAX(16INIT 11
     10),    QFULL(160), AFULL(160), DXDT(160),C1(160), SLOPE(160),     INIT 12
     2       DIST(160), GEOM1(160), ROUGH(160), NOE(160), NUE(160,3),   INIT 13
     3       INUE(160,3), NTYPE(160), JR(160), NKLASS, NE, NDT, EPSIL,  INIT 14
     4       TIME, DT, M, KFULL, N, NOS, NPOLL, NPRINT, ITER,           INIT 15
     5       QDWF(160), IOLD(160), P1(160), RNOFF(160), QINFIL(160),    INIT 16
     6       WDWF(160,5), PLUTO(160,5), IR(160), P2(160), NIN(1000),    INIT 17
     7       P5(160),P6(160),P7(160),SCF(160),BARREL(160),              INIT 18
     8       TITLE(40), NPE(20), NYN(20), NORDER(70), GEOM2(160),       INIT 19
     9       GEOM3(160) , P4(160),SCOUR(160), KSTORE(160)               INIT 20
      COMMON  BODIN( 2,150),SSIN( 2,150),BODOUT,SSOUT,COLIN(2,150),     INIT 21
     *  QINST,QOUST,QINSTL( 2),QOUSTL( 2),STORL( 2),QOUTO( 2),STORO( 2),INIT 22
     *  NSTOR,KSTOR,IPRINT( 2),IPOL( 2),IFLOOD( 2),ICOST( 2),DEPMAX( 2),INIT 23


     *  ATERM( 2,11),AO2DT2( 2,11),BDEPTH( 2,11),BSTOR( 2,11),COLOUT,   INIT 24
     *  DUMSTR(11),DUMDEP(11),                                          INIT 25
     *  KTSTEP,VOLIN( 2,150),VOLOUT( 2,150),STOR,CUMIN( 2),CUMOUT( 2),  INIT 26
     *  SBOD( 2),SSS( 2),SCOL( 2),                                      INIT 27
     *  ISTMOD( 2),ISTTYP( 2),ISTOUT( 2),
     *  QPUMP( 2),DSTART( 2),DSTOP( 2),
     *  DTON( 2),STORMX( 2),DTPUMP( 2),DTMORE( 2),STORF( 2),APLAN( 2),
     *  CLAND( 2),CSTOR( 2),CPS( 2),CTOTAL( 2),CPCUYD( 2),CPACRE( 2),
     *  LP,JP,LPREV( 2),LABEL,DETENT(150),FRAC(150),OUT1(10,200)
      DIMENSION SUM2(6),QO(160),QI(160),QO1(160),QO2(160)
      EQUIVALENCE (QO1(1),QMAX(1)),(QO2(1),QFULL(1))
      EQUIVALENCE (QO(1),Q(1,2,2)),(QI(1),Q(1,1,2))
      WRITE (6,900)
  900 FORMAT ('1ELEMENT FLOWS, AREAS, AND CONCENTRATIONS ARE INITIALIZED
     1 TO DRY WEATHER FLOW AND INFILTRATION VALUES.',//)
      IF(NPOLL,GT,0) WRITE(6,902)
  902 FORMAT(' ',T21,'FLOW'T31,'AREA',T41,'INIT, VEL,',T55,'BOD',T66,'S,
     1S,',T76,'ECOLI,',/,' ELE, NO,',T13,'TYPE',T21,'(CFS)',T29,'(SQ, FT
     2,)',T43,'(FPS)',T53,'(LBS/CF)',T64,'(LBS/CF)',T75,'(MPN/ML)',T87,
     3'CPOLL NO,4',/)
      IF(NPOLL,LT,1) WRITE(6,903)
  903 FORMAT(' ',T21,'FLOW'T31,'AREA',T41,'INIT, VEL,',/,' ELE, NO,',T13
     1,'TYPE',T21,'(CFS)',T29,'(SQ, FT,)',T43,'(FPS)',/)
      DO 100 I=1,NE
      M = JR(I)
C     SUM UPSTREAM FLOWS AND POLLUTANT INFLOWS,
      SUM1 = 0,0
      DO 10 K=1,NPOLL
   10 SUM2(K) = 0,0
      DO 20 J=1,3
      L=INUE(M,J)
      NTU=NTYPE(L)
C****     NEXT CARD CHANGED BY TS OF EH%A ON  1/25/76        *************
      IF(NTU,LE,27,OR,NTU,GE,33) GO TO 18
      KK=GEOM3(L)
      QQ=QO2(L)
      IF(NOE(M),EQ,KK)QQ=QO1(L)
      GO TO 19
   18 QQ = Q(L,2,1)*BARREL(L)
   19 SUM1=SUM1+QQ
      DO 20 K=1,NPOLL
   20 SUM2(K)=SUM2(K)+CPOL2(L,1,K) * QQ
      SUM1 = SUM1+QINFIL(M)+QDWF(M)*DVDWF(KDAY)*HVDWF(KHOUR)
      Q(M,1,1) = SUM1/BARREL(M)
      Q(M,2,1) = Q(M,1,1)
      IF(Q(M,1,1),LT,0,0) Q(M,1,1)=0,0
      IF(Q(M,2,1),LT,0,0) Q(M,2,1) =0,0
      IF (SUM1,EQ,0,0) GO TO 40
      IF(NPOLL,LT,1) GO TO 40
      DO 30 K=1,NPOLL
      IF(K,EQ,1) SUM2(K)=SUM2(K)+WDWF(M,K)*DVBOD(KDAY)*HVBOD(KHOUR)*
     *DVDWF(KDAY)*HVDWF(KHOUR)
      IF(K,EQ,2) SUM2(K)=SUM2(K)+WDWF(M,K)*DVSS(KDAY)*HVSS(KHOUR)*
     *DVDWF(KDAY)*HVDWF(KHOUR)
      IF (K,EQ,3) SUM2(K)=SUM2(K)+WDWF(M,K)*1,0*HVCOLI(KHOUR)*DVDWF(KDAY
     *)*HVDWF(KHOUR)
      CPOL1(M,1,K) = SUM2(K)/SUM1
   30 CPOL2(M,1,K) = CPOL1(M,1,K)
   40 NT = NTYPE(M)
C****     NEXT CARD CHANGED BY TS OF EH%A ON  1/25/76        *************
      IF (NT,EQ,32) GO TO 44
C****     NEXT CARD CHANGED BY TS OF EH%A ON  1/25/76        *************
      IF(NT,LT,28,OR,NT,GT,32) GO TO 45
C     ASSUME ALL DWF IS NON*DIVERTED IN A FLOW DIVIDER TYPE ELEMENT,
      QO1(M)=SUM1
      QO2(M)=0,0
      GO TO 45
   44 QO1(M) = 0,0
      QO2(M) = SUM1
   45 IF (KLASS(NT).EQ.3) GO TO 80
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C     DETERMINE INITIAL FLOW AREA FOR CONDUITS.                         INIT 91
      PS = Q(M,1,1)/QFULL(M)                                            INIT 92
      CALL FINDA(PS,A(M,1,1))                                           INIT 93
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      A(M,2,1) = A(M,1,1)                                               INIT 94
   80 CONTINUE                                                          INIT 95
      IF(A(M,1,1),GT,0,0)GO TO 90                                       INIT 96
      VELINT=0,0                                                        INIT 97
      GO TO 100                                                         INIT 98
   90 VELINT=SUM1/A(M,1,1)                                              INIT 99
      IF(NPOLL,LT,1) WRITE(6,901) NOE(M),NT,SUM1,A(M,1,1),VELINT        INIT100
      IF(NPOLL,LT,1) GO TO 100                                          INIT101
      WRITE(6,901)  NOE(M),NT,SUM1,A(M,1,1),VELINT,(CPOL1(M,1,K),K=1,   INIT102
     1NPOLL)                                                            INIT103
  901 FORMAT(T2,I5,T11,I5,T19,F8,3,T28,F8,3,T43,F8,4,T52,F8,4,T63,F8,4, INIT104
     1T75,1PE8,2,T88,0PF8,4)                                            INIT105
  100 CONTINUE                                                          INIT106
      RETURN                                                            INIT107
      END                                                               INIT108
*DECK,ROUTE
      SUBROUTINE ROUTE(NITER)                                           ROUT  1
C=======================================================================ROUT  2
C     ROUTING SUBPROGRAM FOR FLOW THROUGH SEWER ELEMENTS.               ROUT  3
C     IN PROGRAM, ALPHA REPRESENTS NORMALIZED AREA, A/AFULL.            ROUT  4
C     IN PROGRAM, PSI AND PS REPRESENT NORMALIZED FLOW, Q/QFULL.        ROUT  5
      DIMENSION QI(160),QO(160),SURGE1(160),SURGE2(160),WELL1(160),     ROUT  6
     1 WELL2(160),PUMP(160),       QO1(160),QO2(160)                    ROUT  7
      COMMON/TABLES/ KDEPTH(35),KLASS(35),PSIMAX(25),ALFMAX(25),NN(35),
     1               MM(35),ANORM(25,51),QNORM(25,51),DNORM(25,51),
     2   AFACT(25),  RFACT(25)
      COMMON /NAMES/ NAME(4,35),GNO,YES,BLANK
      COMMON A(160,2,2),Q(160,2,2),CPOL1(160,2,5),CPOL2(160,2,5),QMAX(16ROUT 12
     10),     QFULL(160), AFULL(160), DXDT(160),C1(160), SLOPE(160),    ROUT 13
     2        DIST(160), GEOM1(160), ROUGH(160), NOE(160), NUE(160,3),  ROUT 14
     3        INUE(160,3), NTYPE(160), JR(160), NKLASS, NE, NDT, EPSIL, ROUT 15
     4        TIME, DT, M, KFULL, N, NOS, NPOLL, NPRINT, ITER,          ROUT 16
     5        QDWF(160), IOLD(160), P1(160), RNOFF(160), QINFIL(160),   ROUT 17
     6        WDWF(160,5), PLUTO(160,5), IR(160), P2(160), NIN(1000),   ROUT 18
     7        P5(160),P6(160),P7(160),SCF(160),BARREL(160),             ROUT 19
     8        TITLE(40), NPE(20), NYN(20), NORDER(70), GEOM2(160),      ROUT 20
     9        GEOM3(160) , P4(160),SCOUR(160), KSTORE(160)              ROUT 21
      COMMON  BODIN( 2,150),SSIN( 2,150),BODOUT,SSOUT,COLIN(2,150),     ROUT 22
     *  QINST,QOUST,QINSTL( 2),QOUSTL( 2),STORL( 2),QOUTO( 2),STORO( 2),ROUT 23
     *  NSTOR,KSTOR,IPRINT( 2),IPOL( 2),IFLOOD( 2),ICOST( 2),DEPMAX( 2),ROUT 24
     *  ATERM( 2,11),AO2DT2( 2,11),BDEPTH( 2,11),BSTOR( 2,11),COLOUT,   ROUT 25
     *  DUMSTR(11),DUMDEP(11),                                          ROUT 26
     *  KTSTEP,VOLIN( 2,150),VOLOUT( 2,150),STOR,CUMIN( 2),CUMOUT( 2),  ROUT 27
     *  SBOD( 2),SSS( 2),SCOL( 2),                                      ROUT 28
     *  ISTMOD( 2),ISTTYP( 2),ISTOUT( 2),                               ROUT 29
     *  QPUMP( 2),DSTART( 2),DSTOP( 2),                                 ROUT 30
     *  DTON( 2),STORMX( 2),DTPUMP( 2),DTMORE( 2),STORF( 2),APLAN( 2),  ROUT 31
     *  CLAND( 2),CSTOR( 2),CPS( 2),CTOTAL( 2),CPCUYD( 2),CPACRE( 2),   ROUT 32
     *  LP,JP,LPREV( 2),LABEL,DETENT(150),FRAC(150),OUT1(10,200)        ROUT 33
      EQUIVALENCE (QO(1),Q(1,2,2)),(QI(1),Q(1,1,2))                     ROUT 34
      EQUIVALENCE (PUMP(1),DIST(1)),(SURGE1(1),P1(1)),(SURGE2(1),P2(1)) ROUT 35
      EQUIVALENCE (QO1(1),QMAX(1)),(QO2(1),QFULL(1))                    ROUT 36
      EQUIVALENCE (WELL1(1),SLOPE(1)),(WELL2(1),ROUGH(1))               ROUT 37
      DATA WT/0.55/,WD/0.55/                                            ROUT 38
```

```
C     USE GENERALIZED WEIGHTS OF TIME AND SPACE DERIVATIVES OF
C     CONTINUITY EQUATION,
C     WT=WEIGHT ON TIME DERIVATIVE,
C     WD=WEIGHT ON SPATIAL DERIVATIVE,
C     THESE CONSTANTS APPEAR IN DEFINITIONS OF C1(M) AND C2,
C     NOTE, WT=WD=0,5 CORRESPOND TO ORIGINAL VERSION OF TRANSPORT MODEL,
C     WT=WD=0,55 APPEAR TO GIVE BEST ATTENUATION OF HYDROGRAPHS,
      NT = NTYPE(M)
C     M = ELEMENT NUMBER
C     KLASS(NT)=1 FOR CONDUIT WITH FUNCTIONAL Q-A RELATIONSHIP,
C     KLASS(NT)=2 FOR CONDUIT WITH TABULAR Q-A RELATIONSHIP,
C     KLASS(NT)=3 FOR ELEMENT OTHER THAN CONDUIT,
      K = KLASS(NT)
      GO TO (5,5,200), K
C     COMPUTE TOTAL HEAD SLOPE AND ASSOCIATED PARAMETERS,
C     KFULL=1 IF CONDUIT IS FULL AT UPSTREAM END,
C     KFULL=2 IF CONDUIT IS NOT FULL AT UPSTREAM END,
    5 IF (KFULL,EQ,1) GO TO 10
      IF (SCF(M),EQ,GNO) GO TO 6
C     NO ITERATIONS REQUIRED FOR CONDUITS WITH SUPER-CRITICAL FLOW,
      ITER = 0
      GO TO (20,100), K
    6 IF(ITER,GT,NITER) GO TO 7
       QOLD=QFULL(M)
      A1 = A(M,1,1)/AFULL(M)
      A2 = A(M,2,1)/AFULL(M)
      DV =  (VEL(Q(M,1,1),A(M,1,1))**2- VEL(Q(M,2,1),A(M,2,1))**2)/
     1DIST(M)/64,4
      WSLOPE = SLOPE(M)+P2(M)*(DEPTH(A1)-DEPTH(A2))+DV
      GO TO 9
    7 A1 = A(M,1,2)/AFULL(M)
      A2 = A(M,2,2)/AFULL(M)
      DV =  (VEL(Q(M,1,2),A(M,1,2))**2- VEL(Q(M,2,2),A(M,2,2))**2)/
     1DIST(M)/64,4
      WSLOPE = SLOPE(M)+P2(M)*(DEPTH(A1)-DEPTH(A2))+DV
    9 IF (WSLOPE,LT,SLOPE(M)) WSLOPE = SLOPE(M)
    8 QFULL(M) = P1(M)*SQRT(WSLOPE)
      DELQ=ABS(QFULL(M)-QOLD)
      IF(DELQ,LT,,00002*QFULL(M)) ITER=0
      QFULL(M)=QOLD+(QFULL(M)-QOLD)/2,
      QOLD=QFULL(M)
      IF (ITER-NITER,GE,NITER-1) ITER=0
   10 C1(M) = AFULL(M)/QFULL(M)*DXDT(M)*WT/WD
      QMAX(M) = P4(M)*QFULL(M)
      GO TO (20,100), K
C     ROUTINE FOR CONDUIT WITH FUNCTIONAL Q-A RELATIONSHIP,
C     FIND NEW UPSTREAM AREA,
   20 GO TO (25,30), KFULL
   25 A(M,1,2)=AFULL(M)
      GO TO 40
   30 C2 = -Q(M,1,2)/QFULL(M)
      ALPHA = A(M,1,1)/AFULL(M)
      CALL NEWTON(ALPHA,PS,0,0,C2,KFLAG)
      IF (KFLAG,NE,2) GO TO 35
      WRITE (6,910) TIME,N,NOE(M),A(M,1,1)
      ALPHA = A(M,1,1)/AFULL(M)
   35 A(M,1,2) = ALPHA*AFULL(M)
C     ASSIGN VALUES TO CONSTANTS AND SOLVE FOR DOWNSTREAM Q AND A,
   40 C2 = (1,0-WD)*Q(M,2,1)-(1,0-WD)*Q(M,1,1)-WD*Q(M,1,2)
      C2 = C2+DXDT(M)*((1,0-WT)*A(M,1,2)-(1,0-WT)*A(M,1,1)-WT*A(M,2,1))
      C2 = C2/QFULL(M)/WD
      ALPHA = A(M,2,1)/AFULL(M)
      CALL NEWTON(ALPHA,PS,C1(M),C2,KFLAG)
      GO TO (45,50),KFLAG
C     DOWNSTREAM Q AND A MAY NOW BE CALCULATED,
   45 A(M,2,2) = ALPHA*AFULL(M)
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```
      Q(M,2,2) = PS*QFULL(M)
      RETURN
C     DETERMINE REASON FOR NON-CONVERGENCE,
C     THEN USE DEFAULT OPTIONS TO DETERMINE Q AND A,
   50 IF(NPRINT,LT,1) GO TO 52
      WRITE (6,900)
  900 FORMAT (/' ITERATION FOR DOWNSTREAM FLOW HAS NOT CONVERGED,'/
     13X'TIME  ELEMENT  QFULL  AFULL  DXDT  Q(M,1,1) Q(M,1,2) Q(M,2,1) A
     2(M,1,1) A(M,1,2) A(M,2,1) ALPHA')
      WRITE(6,901) TIME,M,QFULL(M),AFULL(M),DXDT(M),Q(M,1,1),Q(M,1,2),
     1Q(M,2,1),A(M,1,1),A(M,1,2),A(M,2,1),ALPHA
  901 FORMAT (F8,1,I6,F9,1,F7,2,F7,1,3F9,2,3F9,3,F7,3)
C     SEE IF LINE-C1*ALPHA-C2 INTERSECTS Q-A CURVE,
   52 IF ((-C1(M)*ALFMAX(NT)-C2),GT,P4(M)) GO TO 60
      IF(C2,GT,0) GO TO 65
C     REASON FOR NON-CONVERGENCE UNDETERMINED,
C     LET NEW Q AND A EQUAL VALUES AT PREVIOUS TIME STEP,
      IF (NPRINT,GE,1) WRITE (6,902)
  902 FORMAT (' REASON FOR NON-CONVERGENCE UNDETERMINED, USE Q.A VALUES
     1AT PREVIOUS TIME STEP,'//)
      A(M,2,2) = A(M,2,1)
      Q(M,2,2) = Q(M,2,1)
      RETURN
C     CONTINUITY EQUATION TRIES TO FORCE Q,GT,QMAX,
C     LET DOWNSTREAM FLOW BE QFULL UNLESS UPSTREAM Q IS GT QFULL,
   60 IF (NPRINT,GE,1) WRITE (6,903)
  903 FORMAT (' CONTINUITY EQN TRIES TO FORCE Q,GT,QMAX, USE QFULL UNLES
     1S UPSTREAM Q,GT,QFULL - THEN USE UPSTREAM VALUE,')
      IF(Q(M,1,2),GT,QFULL(M)) GO TO 75
      Q(M,2,2) = QFULL(M)
      A(M,2,2) = AFULL(M)
      RETURN
C     CONTINUITY EQUATION TRIES TO FORCE Q, LT, ZERO,
C     LET DOWNSTREAM FLOW BE ZERO,
   65 IF (NPRINT,GE,1) WRITE (6,904)
  904 FORMAT (' CONTINUITY EQN TRIES TO FORCE Q,LT,ZERO, USE ZERO,')
      Q(M,2,2) = 0,0
      A(M,2,2)=0,0
      RETURN
   75 Q(M,2,2) = Q(M,1,2)
      A(M,2,2) = A(M,1,2)
      RETURN
C     ROUTINE FOR CONDUIT WITH TABULAR Q-A RELATIONSHIP,
  100 DALPHA = ANORM(NT,2)-ANORM(NT,1)
      MMM = MM(NT)
C     CALCULATE UPSTREAM AREA,
      GO TO (102,105),KFULL
  102 A(M,1,2) = AFULL(M)
      GO TO 115
  105 PS = Q(M,1,2)/QFULL(M)
      CALL FINDA(PS,A(M,1,2))
C     CALCULATE DOWNSTREAM Q AND A,
  115 ISIGN = 1
      IF (A(M,1,2),LT,A(M,1,1)) ISIGN = -1
      ICHK = 1
      I =IOLD(M)
      C2 = (1,0-WD)*Q(M,2,1)-(1,0-WD)*Q(M,1,1)-WD*Q(M,1,2)
      C2 = C2+DXDT(M)*((1,0-WT)*A(M,1,2)-(1,0-WT)*A(M,1,1)-WT*A(M,2,1))
      C2 = C2/QFULL(M)/WD
C     CALCULATE SLOPE OF LINE SEGMENT I OF Q-A CURVE,
  120 SLUPE=(QNORM(NT,I+1)-QNORM(NT,I))/DALPHA
      IF(SLUPE+C1(M),EQ,0,0) GO TO 130
C     COMPUTE ALPHA CORRESPONDING TO INTERSECTION OF LINE SEGMENT I OF
C        Q-A CURVE WITH LINE -C1*ALPHA-C2,
      ALPHA=(-QNORM(NT,I)-C2+SLUPE*ANORM(NT,I))/(SLUPE+C1(M))
C     CHECK TO SEE IF ALPHA IS IN PROPER RANGE.
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      IF (ALPHA,GT,1.0.OR,ALPHA,LT,0) GO TO 125                         ROUT171
      L=  (ALPHA/DALPHA) + 1,0                                          ROUT172
      PS = QNORM(NT,L)+(ALPHA-ANORM(NT,L))/DALPHA *(QNORM(NT,L+1)       ROUT173
     1-QNORM(NT,L))                                                     ROUT174
      IF(ABS(PS+C1(M)*ALPHA+C2),LE,EPSIL) GO TO 150                     ROUT175
C     TRY NEXT LINE SEGMENT,                                            ROUT176
  125 I = I+ISIGN                                                       ROUT177
  126 IF (I,GT,0,AND,I,LT,MMM) GO TO 120                                ROUT178
      GO TO  (127,50),ICHK                                              ROUT179
C     IF I HAS REACHED ZERO OR MMM START AT IOLD AND GO OTHER WAY       ROUT180
  127 ISIGN = -ISIGN                                                    ROUT181
      I = IOLD(M)+ISIGN                                                 ROUT182
      ICHK = 2                                                          ROUT183
      GO TO 126                                                         ROUT184
C     LINE-C1*ALPHA-C2 AND LINE SEGMENT ARE PARALLEL.                   ROUT185
C     CHECK TO SEE IF THEY ARE CO-LINEAR,                               ROUT186
  130 IF(ABS(C2+QNORM(NT,I)-SLUPE*ANORM(NT,I)),GT,EPSIL) GO TO 125      ROUT187
      ALPHA = ANORM(NT,I)+DALPHA/2,0                                    ROUT188
      L=  (ALPHA/DALPHA) + 1,0                                          ROUT189
      PS = QNORM(NT,L)+(ALPHA-ANORM(NT,L))/DALPHA *(QNORM(NT,L+1)       ROUT190
     1-QNORM(NT,L))                                                     ROUT191
  150 A(M,2,2) = ALPHA*AFULL(M)                                         ROUT192
      Q(M,2,2) = PS*QFULL(M)                                            ROUT193
      RETURN                                                            ROUT194
C     ELEMENT IS NOT A CONDUIT,                                         ROUT195
C****    NEXT CARD CHANGED BY TS OF EH%A ON  1/25/76        *************
  200 NGOTO = NT-25                                                     ROUT196
      IF (NGOTO,LT,1) GO TO 210                                         ROUT197
      GO TO (220,230,250,400,500,250,520,220,220,220), NGOTO            ROUT198
C     ERROR***CONDUITS SHOULD BE KLASS 1 OR 2                           ROUT199
  210 QO(M)=QI(M)                                                       ROUT200
      WRITE (6,905) M                                                   ROUT201
  905 FORMAT (/' ERROR: CONDUITS SHOULD BE CLASS 1 OR 2, M='I5)         ROUT202
      RETURN                                                            ROUT203
C     MANHOLE *** SIMPLY TRANSLATE FLOW WITH NO TIME DELAY              ROUT204
  220 QO(M)=QI(M)                                                       ROUT205
      RETURN                                                            ROUT206
C     LIFT STATION***PUMPS ASSUMED TO BE PUMPING AT CONSTANT RATE       ROUT207
C     FORCE MAIN ASSUMED TO REMAIN FULL AT ALL TIMES RESULTING IN NO    ROUT208
C     (=PUMP(M)),                                                       ROUT209
C      VOLUME IN WET WELL INITIALLY IS HALF THE CAPACITY(GEOM1),        ROUT210
C     TIME DELAY,                                                       ROUT211
  230 WELL2(M) = WELL2(M)+QI(M)*DT                                      ROUT212
      IF (WELL2(M)-GEOM1(M))233,234,234                                 ROUT213
  233 QO(M) = 0,0                                                       ROUT214
      RETURN                                                            ROUT215
  234 IF (WELL2(M),GE,PUMP(M)*DT) GO TO 236                             ROUT216
      QO(M) = WELL2(M)/DT                                               ROUT217
      WELL2(M) = 0.0                                                    ROUT218
      RETURN                                                            ROUT219
  236 QO(M) = PUMP(M)                                                   ROUT220
      WELL2(M) = WELL2(M)-PUMP(M)*DT                                    ROUT221
      RETURN                                                            ROUT222
C****    NEXT CARD CHANGED BY TS OF EH%A ON  1/25/76        *************
C     ROUTINE FOR TYPE 28 AND TYPE 31 FLOW DIVIDERS.                    ROUT223
C     TYPE 28 MAY BE USED FOR A SIMPLE OVERFLOW STRUCTURE,              ROUT224
C     TYPE 31 MAY BE USED WITH A CUNNETTE SECTION DOWNSTREAM,           ROUT225
  250 QO(M) = QI(M)                                                     ROUT226
      IF (QI(M),GT,GEOM1(M)) GO TO 255                                  ROUT227
      QO1(M) = QI(M)                                                    ROUT228
      QO2(M) = 0,0                                                      ROUT229
      RETURN                                                            ROUT230
  255 QO1(M) = GEOM1(M)                                                 ROUT231
      QO2(M) = QI(M)-GEOM1(M)                                           ROUT232
      RETURN                                                            ROUT233
C     STORAGE UNIT. ADAPTED FROM M+F ROUTINE.                           ROUT234
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  400   KSTOR = KSTORE(M)                                                 ROUT235
      IF (IFLOOD(KSTOR) ,EQ, 1)  GO TO 450                                ROUT236
        KTSTEP= N                                                         ROUT237
        QINST = QI(M)                                                     ROUT238
      IF(NPOLL,LT,1) GO TO 430                                            ROUT239
      DO 420 IP=1,NPOLL                                                   ROUT240
      CPOL1(M,2,IP) = 0,0                                                 ROUT241
      IF(QI(M),LE,0,0) GO TO 420                                          ROUT242
      DO 415 J=1,3                                                        ROUT243
      NNEED = INUE(M,J)                                                   ROUT244
      NTU = NTYPE(NNEED)                                                  ROUT245
C****    NEXT CARD CHANGED BY TS OF EH%A ON  1/25/76        *************
      IF (NTU,LE,27,OR,NTU,GE,33) GO TO 413                               ROUT246
      L = GEOM3(NNEED)                                                    ROUT247
      QQ = QO2(NNEED)                                                     ROUT248
      IF (NOE(M),EQ,L) QQ=QO1(NNEED)                                      ROUT249
      GO TO 415                                                           ROUT250
  413 QQ = QO(NNEED)                                                      ROUT251
  415 CPOL1(M,2,IP) = CPOL1(M,2,IP) + CPOL2(NNEED,2,IP) * QQ              ROUT252
      CPOL1(M,2,IP) = CPOL1(M,2,IP)/QI(M)                                 ROUT253
  420 CONTINUE                                                            ROUT254
        BODIN(KSTOR,KTSTEP) = CPOL1(M,2,1) * QI(M) * DT                   ROUT255
        SSIN( KSTOR,KTSTEP) = CPOL1(M,2,2) * QI(M) * DT                   ROUT256
        COLIN(KSTOR,KTSTEP) = CPOL1(M,2,3) * QI(M) * DT                   ROUT257
  430 CALL TSTORG                                                         ROUT258
      IF (ISTOUT(KSTOR),NE,9) QO2(M)=QOUST                                ROUT259
        QO(M) = QOUST                                                     ROUT260
      IF(QO(M),GT,0,0) GO TO 440                                          ROUT261
      CPOL2(M,2,1) = 0,0                                                  ROUT262
      CPOL2(M,2,2) = 0,0                                                  ROUT263
      CPOL2(M,2,3) = 0,0                                                  ROUT264
      RETURN                                                              ROUT265
  440 IF(NPOLL,LT,1) RETURN                                               ROUT266
        CPOL2(M,2,1)   = BODOUT/(QO(M)*DT)                                ROUT267
        CPOL2(M,2,2)   =  SSOUT/(QO(M)*DT)                                ROUT268
        CPOL2(M,2,3)   = COLOUT/(QO(M)*DT)                                ROUT269
  450 RETURN                                                              ROUT270
C****    NEXT CARD CHANGED BY TS OF EH%A ON  1/25/76        *************
C     ROUTINE FOR TYPE 30 FLOW DIVIDER,                                   ROUT271
C     USE WITH SIDE WEIR OR OTHER WEIR TYPE DIVERSION,                    ROUT272
C     DIST=MAX FLOW WITHOUT FLOW OVER WEIR,                               ROUT273
C     SLOPE=MAXIMUM FLOW THROUGH WHOLE STRUCTURE,                         ROUT274
C     ROUGH=WEIR CONSTANT TIMES WEIR LENGTH,                              ROUT275
C     GEOM1 = WEIR HEIGHT,                                                ROUT276
C     GEOM2 = DEPTH IN STRUCTURE AT TIME OF MAXIMUM FLOW,                 ROUT277
C     GEOM3 = DOWNSTREAM EXT, ELE, NUM, INTO WHICH GOES UNDIVERTED FLOW,ROUT278
C     FLOW OVER WEIR IS THE DIVERTED FLOW,                                ROUT279
  500 QO(M) = QI(M)                                                       ROUT280
      IF (QI(M),GT,DIST(M)) GO TO 505                                     ROUT281
      QO2(M) = 0,0                                                        ROUT282
      QO1(M) = QI(M)                                                      ROUT283
      RETURN                                                              ROUT284
  505 DH = (QI(M)-DIST(M))/(SLOPE(M)-DIST(M))*(GEOM2(M)-GEOM1(M))         ROUT285
      QO2(M) = ROUGH(M)*DH*SQRT(DH)                                       ROUT286
      QO1(M) = QI(M)-QO2(M)                                               ROUT287
      RETURN                                                              ROUT288
C     ROUTINE FOR BACKWATER ELEMENT,                                      ROUT289
C     ELEMENT ACTS AS FLOW DIVIDER,                                       ROUT290
C     GEOM3=ELEMENT NUMBER OF DOWNSTREAM STORAGE UNIT,                    ROUT291
  520 QO(M) = QI(M)                                                       ROUT292
      L = GEOM3(M)                                                        ROUT293
      L = NIN(L)                                                          ROUT294
      KSTOR = KSTORE(L)                                                   ROUT295
C     IF BACKWATER EXTENDS ALL THE WAY UP TO ELEMENT,                     ROUT296
C     THEN WHOLE FLOW IS DIVERTED TO STORAGE ELEMENT,                     ROUT297
C     ASSUME LENGTH OF BACKWATER IS PROPORTIONAL TO SQRT OF STORAGE.      ROUT298
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C     VOLUME,
      QO1(M) = QI(M)*SQRT(STORL(KSTOR)/BSTOR(KSTOR,11))
      QO2(M) = QI(M)-QO1(M)
      RETURN
  910 FORMAT (/' **WARNING: NEWTON UNABLE TO FIND AREA GIVEN FLOW, TIME=
     1'F7.1,', TIME STEP='I3,', EXT. ELE. NUM.='I4,', USE OLD UPSTREAM A
     2REA='F6,2)
      END
*DECK,QUAL
      SUBROUTINE QUAL(DUMY2,DUMY3,DUMY4,DUMY5)
C=======================================================================
C     ROUTING SUBPROGRAM FOR POLLUTANTS MOVING THROUGH SEWER ELEMENTS
C     COMPLETE MIXING ASSUMED IN ALL ELEMENTS SURFACE AND SUB-
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C     SURFACE INPUTS(PIPEFLOW,GROUNDWATER,SEWAGE, AND CATCHBASIN OUTFLOW
C      MIXING VOLUME IS THE DIFFERENTIATING FACTOR THAT AFFECTS QUALITY
C     CHANGE FROM ONE ELEMENT TO THE NEXT
      DIMENSION SURGE1(160),SURGE2(160),WELL1(160),WELL2(160)
     1,QO(160),QI(160),QO1(160),QO2(160),PUMP(160)
      COMMON/TABLES/ KDEPTH(35),KLASS(35),PSIMAX(25),ALFMAX(25),NN(35),
     1               MM(35),ANORM(25,51),QNORM(25,51),DNORM(25,51),
     2   AFACT(25),  RFACT(25)
      COMMON A(160,2,2),Q(160,2,2),CPOL1(160,2,5),CPOL2(160,2,5),QMAX(16
     10),     QFULL(160), AFULL(160), DXDT(160),C1(160), SLOPE(160),
     2        DIST(160), GEOM1(160), ROUGH(160), NOE(160), NUE(160,3),
     3        INUE(160,3), NTYPE(160), JR(160), NKLASS, NE, NDT, EPSIL,
     4        TIME, DT, M, KFULL, N, NOS, NPOLL, NPRINT, ITER,
     5        QDWF(160), IOLD(160), P1(160), RNOFF(160), QINFIL(160),
     6        WDWF(160,5), PLUTO(160,5), IR(160), P2(160), NIN(1000),
     7        P5(160),P6(160),P7(160),SCF(160),BARREL(160),
     8        TITLE(40), NPE(20), NYN(20), NORDER(70), GEOM2(160),
     9        GEOM3(160) , P4(160),SCOUR(160), KSTORE(160)
      COMMON  BODIN( 2,150),SSIN( 2,150),BODOUT,SSOUT,COLIN(2,150),
     *  QINST,QOUST,QINSTL( 2),QOUSTL( 2),STORL( 2),QOUTO( 2),STORO( 2),
     *  NSTOR,KSTOR,IPRINT( 2),IPOL( 2),IFLOOD( 2),ICOST( 2),DEPMAX( 2),
     *  ATERM( 2,11),AO2DT2( 2,11),BDEPTH( 2,11),BSTOR( 2,11),COLOUT,
     *  DUMSTR(11),DUMDEP(11),
     *  KTSTEP,VOLIN( 2,150),VOLOUT( 2,150),STOR,CUMIN( 2),CUMOUT( 2),
     *  SBOD( 2),SSS( 2),SCOL( 2),
     *  ISTMOD( 2),ISTTYP( 2),ISTOUT( 2),
     *  QPUMP( 2),DSTART( 2),DSTOP( 2),
     *  DTON( 2),STORMX( 2),DTPUMP( 2),DTMORE( 2),STORF( 2),APLAN( 2),
     *  CLAND( 2),CSTOR( 2),CPS( 2),CTOTAL( 2),CPCUYD( 2),CPACRE( 2),
     *  LP,JP,LPREV( 2),LABEL,DETENT(150),FRAC(150),OUT1(10,200)
      EQUIVALENCE (PUMP(1),DIST(1)),(SURGE1(1),P1(1)),(SURGE2(1),P2(1))
      EQUIVALENCE (QO1(1),QMAX(1)),(QO2(1),QFULL(1))
      EQUIVALENCE (QO(1),Q(1,2,2)),(QI(1),Q(1,1,2))
      EQUIVALENCE (WELL1(1),SLOPE(1)),(WELL2(1),ROUGH(1))
      REAL KVAL
      P3=2./DT
      NT=NTYPE(M)
      GO TO(110,110,110,110,110,110,110,110,110,110,110,110,
C****    NEXT CARD CHANGED BY TS OF EH%A ON  1/25/76        *************
     1 110,110,110,110,110,110,110,110,110,110,110,110,110,
C****    NEXT CARD ADDED BY TS OF EH%A ON  1/25/76          *************
     2 120,130,120,120,120,120,120,150), NT
C     PIPE***MIXING VOLUME FOUND BY AVERAGING UPSTREAM AND DOWNSTREAM
C     FLOW AREAS AND BY MULTIPLYING BY LENGTH OF PIPE
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```
  110 VOL1=DIST(M)*(A(M,1,1)+A(M,2,1))/2,0*BARREL(M)                    QUAL 46
      VOL2=DIST(M)*(A(M,1,2)+A(M,2,2))/2,0*BARREL(M)                    QUAL 47
      AREAF=(A(M,1,2)+A(M,2,2))/2,                                      QUAL 48
      RHYD=RADH(AREAF)                                                  QUAL 49
      GO TO 160                                                         QUAL 50
C     MANHOLE***MIXING VOLUME IS VOLUME CURRENTLY STORED AS SURCHARGING QUAL 51
  120 VOL1=SURGE1(M)                                                    QUAL 52
      VOL2=SURGE2(M)                                                    QUAL 53
      SURGE1(M)=SURGE2(M)                                               QUAL 54
      GO TO 160                                                         QUAL 55
C     LIFT STATION***MIXING VOLUME IS VOLUME CURRENTLY IN WET WELL      QUAL 56
  130 VOL1=WELL1(M)                                                     QUAL 57
      VOL2=WELL2(M)                                                     QUAL 58
      WELL1(M)= WELL2(M)                                                QUAL 59
      GO TO 160                                                         QUAL 60
C     ME FLOW CONTROL STRUCTURES***MIXING VOLUMES INITIALLY ZERO        QUAL 61
  150 VOL1=0,0                                                          QUAL 62
      VOL2=0,0                                                          QUAL 63
C     QUALITY CONCENTRATIONS(LBS PER CU, FT,)***CPOL1(M,2,X)            QUAL 64
C     POUNDS POLLUTANT IN SEWAGE                                        QUAL 65
  160 DO 172 IP=1, NPOLL                                                QUAL 66
      TOTAL1=0,0                                                        QUAL 67
      DO 170 JJP=1,3                                                    QUAL 68
      NNEED=INUE(M,JJP)                                                 QUAL 69
      NTU=NTYPE(NNEED)                                                  QUAL 70
C****    NEXT CARD CHANGED BY TS OF EH%A ON  1/25/76       *************
      IF(NTU,LE,27,OR,NTU,GE,33)GO TO 168                               QUAL 71
      KK=GEOM3(NNEED)                                                   QUAL 72
      QQ=QQ2(NNEED)                                                     QUAL 73
      IF(NOE(M),EQ,KK)QQ=QQ1(NNEED)                                     QUAL 74
      GO TO 170                                                         QUAL 75
  168 QQ=Q(NNEED,2,2)                                                   QUAL 76
  170 TOTAL1=TOTAL1+CPOL2(NNEED,2,IP)*QQ                                QUAL 77
      NNEED=IR(M)                                                       QUAL 78
      TOTAL3=PLUTO(NNEED,IP)                                            QUAL 79
      GO TO(210,220,240,230),IP                                         QUAL 80
C     PARAMETERS FOR B O D                                              QUAL 81
  210 TOTAL2= DUMY2                                                     QUAL 82
C     THE NUMBER 0,2314815E-5 = 0,2/(24,0*60,0*60,0)                    QUAL 83
      D1 = 0,2314815E-5                                                 QUAL 84
      D2=0,0                                                            QUAL 85
      S=0,0                                                             QUAL 86
      GO TO 250                                                         QUAL 87
C     PARAMETERS FOR S S                                                QUAL 88
  220 TOTAL2=DUMY3                                                      QUAL 89
      D1=0,0                                                            QUAL 90
      D2=0,0                                                            QUAL 91
      S=0,0                                                             QUAL 92
      IF(QI(M),LE,0,0) GO TO 250                                        QUAL 93
      IF(KLASS(NT),GT,2) GO TO 245                                      QUAL 94
      SPG=2,7                                                           QUAL 95
      KVAL=,056                                                         QUAL 96
C     DETERMINE CRITICAL DIAMETER OF SOLIDS FOR MOTION,                 QUAL 97
      CRITD=RHYD*SLOPE(M)/(KVAL*(SPG-1,0))                              QUAL 98
      CRITD=CRITD*304,8                                                 QUAL 99
      IF(CRITD,LE,,59) PCT1=-1,2471*CRITD+1,0                           QUAL100
      IF(CRITD,GT,,59,AND,CRITD,LE,2,0) PCT1=-,1501*CRITD+,3527         QUAL101
      IF(CRITD,GT,2,0,AND,CRITD,LE,10,0) PCT1=-,00656*CRITD+,0656       QUAL102
      IF(CRITD,GT,10,0) PCT1=0,0                                        QUAL103
      IF(CRITD,LE,0,0) PCT1=1,0                                         QUAL104
      PCT2=PCT1                                                         QUAL105
      SCOUR(M)=SCOUR(M)+PCT2*(TOTAL1+TOTAL2+TOTAL3)*DT                  QUAL106
      TOTAL4=(1,-PCT2)*(TOTAL1+TOTAL2+TOTAL3)+(1,-PCT1)*SCOUR(M)/DT     QUAL107
      CPOL1(M,2,2) = TOTAL4/QI(M)                                       QUAL108
      SCOUR(M)=PCT1*SCOUR(M)                                            QUAL109
C     THE NUMBER 84.28 = 2.7*62.4/2.0                                   QUAL110
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      ULIMIT=84,28*AFULL(M)*DIST(M)*BARREL(M)                           QUAL111
      IF(SCOUR(M),GT,ULIMIT) GO TO 300                                  QUAL112
      GO TO 250                                                         QUAL113
  300 CPOL1(M,2,2) = ((SCOUR(M)-ULIMIT)/QI(M))/DT + CPOL1(M,2,2)        QUAL114
      SCOUR(M)=ULIMIT                                                   QUAL115
      GO TO 250                                                         QUAL116
C     PARAMETERS FOR D O                                                QUAL117
  230 TOTAL2=DUMY4                                                      QUAL118
C     THE NUMBER 0,2314815E-5 = 0,2/(24,0*60,0*60,0)                    QUAL119
C     THE NUMBER 0,3472222E-5 = 0,3/(24,0*60,0*60,0)                    QUAL120
C     THE NUMBER 0,4356716E-3 = 7,0*8,34/134000,0                       QUAL121
      D1 = 0,2314815E-5                                                 QUAL122
      D2 = 0,3472222E-5                                                 QUAL123
      S = 0,4356716E-3                                                  QUAL124
      GO TO 250                                                         QUAL125
C     PARAMETERS FOR NONSETTLABLE, CONSERVATIVE POLLUTANT, (COLIFORM)   QUAL126
  240 TOTAL2=DUMY5                                                      QUAL127
      D1=0,0                                                            QUAL128
      D2=0,0                                                            QUAL129
      S=0,0                                                             QUAL130
      GO TO 250                                                         QUAL131
  245 IF(Q(M,1,2),LE,0,0001) GO TO 171                                  QUAL132
      CPOL1(M,2,IP) = (TOTAL1+TOTAL2+TOTAL3)/Q(M,1,2)                   QUAL133
  250 CONTINUE                                                          QUAL134
C     CONCENTRATION OF INFLOW TO ELEMENT                                QUAL135
      IF(Q(M,1,2),LE,0,0001) GO TO 171                                  QUAL136
      IF(IP,NE,2) CPOL1(M,2,IP) = (TOTAL1+TOTAL2+TOTAL3)/Q(M,1,2)       QUAL137
C     CONCENTRATION OF OUTFLOW FROM ELEMENT                             QUAL138
  171 IF(Q(M,2,2),LE,0,0001) GO TO 172                                  QUAL139
      CPOL2(M,2,IP) = (CPOL2(M,1,IP) * (VOL1*(P3-D1-D2)-Q(M,2,1))+      QUAL140
     1CPOL1(M,1,IP) * Q(M,1,1)+CPOL1(M,2,IP) * Q(M,1,2)+D2*S*(VOL1      QUAL141
     2+VOL2))/(VOL2*(P3+D1+D2)+Q(M,2,2))                                QUAL142
      IF(CPOL2(M,2,IP).LE,0,0) CPOL2(M,2,IP) = 0,0                      QUAL143
  172 CONTINUE                                                          QUAL144
      RETURN                                                            QUAL145
      END                                                               QUAL146
*DECK,PRINT
      SUBROUTINE  PRINT                                                 PRIN  1
C=======================================================================PRIN  2
C                                                                       PRIN  3
C                                                                       PRIN  4
      COMMON /TAPES/ INCNT,IOUTCT,JIN(10),JOUT(10),NSCRAT(5)            PRIN  5
      COMMON A(160,2,2),Q(160,2,2),CPOL1(160,2,5),CPOL2(160,2,5),QMAX(16PRIN  6
     10),     QFULL(160), AFULL(160), DXDT(160),C1(160), SLOPE(160),    PRIN  7
     2        DIST(160), GEOM1(160), ROUGH(160), NOE(160), NUE(160,3),  PRIN  8
     3        INUE(160,3), NTYPE(160), JR(160), NKLASS, NE, NDT, EPSIL, PRIN  9
     4        TIME, DT, M, KFULL, N, NOS, NPOLL, NPRINT, ITER,          PRIN 10
     5        QDWF(160), IOLD(160), P1(160), RNOFF(160), QINFIL(160),   PRIN 11
     6        WDWF(160,5), PLUTO(160,5), IR(160), P2(160), NIN(1000),   PRIN 12
     7        P5(160),P6(160),P7(160),SCF(160),BARREL(160),             PRIN 13
     8        TITLE(40), NPE(20), NYN(20), NORDER(70), GEOM2(160),      PRIN 14
     9        GEOM3(160) , P4(160),SCOUR(160), KSTORE(160)              PRIN 15
      COMMON  BODIN( 2,150),SSIN( 2,150),BODOUT,SSOUT,COLIN(2,150),     PRIN 16
     *  QINST,QOUST,QINSTL( 2),QOUSTL( 2),STORL( 2),QOUTO( 2),STORO( 2),PRIN 17
     *  NSTOR,KSTOR,IPRINT( 2),IPOL( 2),IFLOOD( 2),ICOST( 2),DEPMAX( 2),PRIN 18
     *  ATERM( 2,11),AO2DT2( 2,11),BDEPTH( 2,11),BSTOR( 2,11),COLOUT,   PRIN 19
     *  DUMSTR(11),DUMDEP(11),                                          PRIN 20
     *  KTSTEP,VOLIN( 2,150),VOLOUT( 2,150),STOR,CUMIN( 2),CUMOUT( 2),  PRIN 21
     *  SBOD( 2),SSS( 2),SCOL( 2),                                      PRIN 22
     *  ISTMOD( 2),ISTTYP( 2),ISTOUT( 2),                               PRIN 23
     *  QPUMP( 2),DSTART( 2),DSTOP( 2),                                 PRIN 24
     *  DTON( 2),STORMX( 2),DTPUMP( 2),DTMORE( 2),STORF( 2),APLAN( 2),  PRIN 25
     *  CLAND( 2),CSTOR( 2),CPS( 2),CTOTAL( 2),CPCUYD( 2),CPACRE( 2),   PRIN 26
     *  LP,JP,LPREV( 2),LABEL,DETENT(150),FRAC(150),OUT1(20,150)        PRIN 27
      COMMON /XX/  OUT2(20,150,4),PP(4)                                 PRIN 28
      II=0                                                              PRIN 29
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```
    5 II=II+1
      NTX=NSCRAT(II)
      REWIND NTX
      DO 10 J=1, 20
      NYN(J)=0
      DO 10 N=1,150
      OUT1(J,N)=0,0
      DO 10 I=1,4
      OUT2(J,N,I)=0,0
      PP(I)=0,0
   10 CONTINUE
      READ(NTX) NDT,NNYN,NPOLL,NNPE,DT,JPRINT,JPLOT
      READ(NTX)(NYN(I),I=1,NNYN)
      DO 20 N=1,NDT
      DO 20 J=1,NNYN
      IF(NPOLL,GT,0) READ(NTX) QQ,(PP(I),I=1,NPOLL)
      IF(NPOLL,LT,1) READ(NTX) QQ
      OUT1(J,N)=QQ
      IF(NPOLL,LT,1) GO TO 20
      DO 15  JJ=1,NPOLL
   15 OUT2(J,N,JJ)=PP(JJ)
   20 CONTINUE
      IF(II,GT,1) GO TO 29
C          PRINT INFLOWS
      WRITE(6,921)
  921 FORMAT(//43X,'SELECTED INLET HYDROGRAPHS - CFS')
      WRITE(6,911)(I,I=1,10)
  911 FORMAT(' EXTERNAL'/' ELEMENT    TIME STEP'/' NUMBER',3X,10(I6,4X))
      DO 216 I= 1,NNYN
  216 WRITE(6,912) NYN(I),(OUT1(I,J),J=1,NDT)
  912 FORMAT (/I6,4X,10F10,3,/,(10X,10F10,3))
      IF(NPOLL,LT,1) GO TO 2017
      WRITE(6,922)
  922 FORMAT(1H1,//,43X,'SELECTED INLET POLLUTOGRAPHS')
      WRITE(6,911)(I,I=1,10)
      DO 217 I=1,NNYN
      DO 217 IP=1,NPOLL
      GO TO (30,32,36,34), IP
   30 WRITE(6,960)
  960 FORMAT('0',40X,'*** BOD IN LBS/MIN ***')
      GO TO 160
   32 WRITE(6,961)
  961 FORMAT('0',40X,'** SUSPENDED SOLIDS IN LBS/MIN **')
      GO TO 160
   34 WRITE(6,962)
  962 FORMAT('0',40X,'*** DO ***')
      GO TO 160
   36 WRITE(6,963)
  963 FORMAT('0',40X,'*** COLIFORM IN MPN/MIN ***')
  160 CONTINUE
      IF(IP,NE,3)WRITE(6,912) NYN(I),(OUT2(I,J,IP),J=1,NDT)
      IF(IP,EQ,3)WRITE(6,967) NYN(I),(OUT2(I,J,IP),J=1,NDT)
  967 FORMAT(/I6,4X,1P10E10,2,/,(10X,10E10,2))
  217 CONTINUE
 2017 CONTINUE
      IF(II,LE,1) GO TO 5
C          PRINT OUTFLOWS
   29 WRITE(6,923)
  923 FORMAT(1H1,//,42X,'SELECTED OUTFLOW HYDROGRAPHS - CFS')
      WRITE(6,911)(I,I=1,10)
      DO 218 I=1,NNPE
  218 WRITE(6,912) NYN(I),(OUT1(I,J),J=1,NDT)
  300 IF(NPOLL,LT,1) RETURN
      WRITE(6,924)
  924 FORMAT(1H1,//,42X,'SELECTED OUTFLOW POLLUTOGRAPHS')
      WRITE(6,911)(I,I=1,10)
      DO 219 I=1,NNPE                                                   PRIN 96
      DO 219 IP=1,NPOLL                                                 PRIN 97
      GO TO (40,42,46,44),IP                                            PRIN 98
   40 WRITE(6,960)                                                      PRIN 99
      GO TO 161                                                         PRIN100
   42 WRITE(6,961)                                                      PRIN101
      GO TO 161                                                         PRIN102
   44 WRITE(6,962)                                                      PRIN103
      GO TO 161                                                         PRIN104
   46 WRITE(6,963)                                                      PRIN105
  161 CONTINUE                                                          PRIN106
      IF(IP,NE,3) WRITE(6,912) NYN(I),(OUT2(I,J,IP),J=1,NDT)            PRIN107
      IF(IP,EQ,3) WRITE(6,967) NYN(I),(OUT2(I,J,IP),J=1,NDT)            PRIN108
  219 CONTINUE                                                          PRIN109
C     FIND TOTAL OUTPUT OF SS AND BOD IN POUNDS                         PRIN110
      TSSOUT=0,0                                                        PRIN111
      TBODOT=0,0                                                        PRIN112
      DO 1000 J=1,NDT                                                   PRIN113
      TSSOUT=TSSOUT+OUT2(NNPE,J,2)*DT/60,                               PRIN114
      TBODOT=TBODOT+OUT2(NNPE,J,1)*DT/60,                               PRIN115
 1000 CONTINUE                                                          PRIN116
      WRITE(06,924)                                                     PRIN117
      WRITE(6,911)(I,I=1,10)                                            PRIN118
      DO 236 I=1,NNPE                                                   PRIN119
      DO 236 IP=1,NPOLL                                                 PRIN120
      GO TO (50,52,56,54),IP                                            PRIN121
   50 WRITE(6,968)                                                      PRIN122
  968 FORMAT('0',40X,'*** BOD IN MG/L ****')                            PRIN123
      GO TO 234                                                         PRIN124
   52 WRITE(6,969)                                                      PRIN125
  969 FORMAT('0',40X,'*** SUSPENDED SOLIDS IN MG/L ***')                PRIN126
      GO TO 234                                                         PRIN127
   54 WRITE(6,962)                                                      PRIN128
      GO TO 234                                                         PRIN129
   56 CONTINUE                                                          PRIN130
      IF(IP,EQ,3) WRITE(6,966)                                          PRIN131
  966 FORMAT('0',40X,'***COLIFORM IN MPN/100ML ***')                    PRIN132
  234 CONTINUE                                                          PRIN133
      DO 235 J=1,NDT                                                    PRIN134
      IF(OUT1(I,J),EQ,0,0) GO TO 237                                    PRIN135
      IF(IP,NE,3) OUT2(I,J,IP)=OUT2(I,J,IP)*267,5/OUT1(I,J)             PRIN136
      IF(IP,EQ,3) OUT2(I,J,IP)=OUT2(I,J,IP)/(OUT1(I,J)*17040,0)         PRIN137
      GO TO 238                                                         PRIN138
  237 OUT2(I,J,IP)=0,0                                                  PRIN139
  238 CONTINUE                                                          PRIN140
  235 CONTINUE                                                          PRIN141
      IF(IP,NE,3) WRITE(6,912)NYN(I),(OUT2(I,J,IP),J=1,NDT)             PRIN142
      IF(IP,EQ,3) WRITE (6,967)NYN(I),(OUT2(I,J,IP),J=1,NDT)            PRIN143
  236 CONTINUE                                                          PRIN144
      WRITE(06,965) NYN(NNPE),TSSOUT,NYN(NNPE),TBODOT                   PRIN145
  965 FORMAT(///,    5X,'TOTAL POUNDS OF SUSPENDED SOLIDS OUTPUT FROM ELPRIN146
     *EMENT ',I3,' =',F10,2,//,  5X,'TOTAL POUNDS OF FIVE-DAY BOD OUTPUTPRIN147
     * FROM ELEMENT ',I3,' =',F10,2////)                                PRIN148
  311 RETURN                                                            PRIN149
      END                                                               PRIN150
*DECK,TSTCST
      SUBROUTINE TSTCST                                                 TSTC  1
C=====================================================================TSTC  2
C****    COMMON AREAS NAMES AND TABLES HAVE BEEN DELETED FROM THIS
C****    ROUTINE SINCE THEY WERE NOT BEING USED BY THIS ROUTINE
C****    DONE BY TS OF EH%A ON  1/25/76      **********************
      COMMON A(160,2,2),Q(160,2,2),CPOL1(160,2,5),CPOL2(160,2,5),QMAX(16TSTC  6
     10),     QFULL(160), AFULL(160), DXDT(160),C1(160), SLOPE(160),    TSTC  7
     2        DIST(160), GEOM1(160), ROUGH(160), NOE(160), NUE(160,3),  TSTC  8
     3        INUE(160,3), NTYPE(160), JR(160), NKLASS, NE, NDT, EPSIL, TSTC  9
     4        TIME, DT, H, KFULL, N, NDS, NPOLL, NPRINT, ITER,          TSTC 10
     5       QDWF(160), IOLD(160), P1(160), RNOFF(160), QINFIL(160),
     6       WDWF(160,5), PLUTO(160,5), IR(160), P2(160), NIN(1000),
     7       P5(160),P6(160),P7(160),SCF(160),BARREL(160),
     8       TITLE(40), NPE(20), NYN(20), NORDER(70), GEOM2(160),
     9       GEOM3(160) , P4(160),SCOUR(160), KSTORE(160)
      COMMON  BODIN( 2,150),SSIN( 2,150),BODOUT,SSOUT,COLIN(2,150),
     *  QINST,QOUST,QINSTL( 2),QOUSTL( 2),STORL( 2),QOUTO( 2),STORO( 2),
     *  NSTOR,KSTOR,IPRINT( 2),IPOL( 2),IFLOOD( 2),ICOST( 2),DEPMAX( 2),
     *  ATERM( 2,11),AO2DT2( 2,11),BDEPTH( 2,11),BSTOR( 2,11),COLOUT,
     *  DUMSTR(11),DUMDEP(11),
     *  KTSTEP,VOLIN( 2,150),VOLOUT( 2,150),STOR,CUMIN( 2),CUMOUT( 2),
     *  SBOD( 2),SSS( 2),SCOL( 2),
     *  ISTMOD( 2),ISTTYP( 2),ISTOUT( 2),
     *  QPUMP( 2),DSTART( 2),DSTOP( 2),
     *  DTON( 2),STORMX( 2),DTPUMP( 2),DTMORE( 2),STORF( 2),APLAN( 2),
     *  CLAND( 2),CSTOR( 2),CPS( 2),CTOTAL( 2),CPCUYD( 2),CPACRE( 2),
     *  LP,JP,LPREV( 2),LABEL,DETENT(150),FRAC(150),OUT1(10,200)
C
      DIMENSION QO1(150),QO2(150)
      EQUIVALENCE (QO1(1),QMAX(1)),(QO2(1),QFULL(1))
C
      DO 9000  KSTOR=1,NSTOR
      IF (ICOST(KSTOR) ,LT,1)  GO TO 9000
C
      WRITE(6,601)  KSTOR
  601 FORMAT('1', 10X, 'SUMMARY OF STORAGE AND COSTS FOR UNIT NO,',I3,/)
      IF (IFLOOD(KSTOR) ,EQ, 1)  GO TO 902
C
        CLAND(KSTOR)  = CPACRE(KSTOR)*APLAN(KSTOR)/43560,0
        CSTOR(KSTOR)  = CPCUYD(KSTOR)*STORMX(KSTOR)/27,0
        CTOTAL(KSTOR) = CLAND(KSTOR) + CSTOR(KSTOR) + CPS(KSTOR)
C
C                    BRANCH TO OUTLET TYPE (ISTOUT)
C
        K = ISTOUT(KSTOR)
      GO TO (8000,8000, 901, 901,4600,4600, 901, 901), K
C
C------------------ COMPUTE AND PRINT STORAGE UNIT COSTS ---------------
C
C                    F) OUTLET BY EXISTING PUMPS
C
C                    FOLLOWING IS TEMPORARY, DOWN TO 8000
C
 4600   DTMORE(KSTOR) = STORF(KSTOR)/(QPUMP(KSTOR)*DT)
        DTPUMP(KSTOR) = DTON(KSTOR) - 1,0 + DTMORE(KSTOR)
      WRITE(6,602)  DTMORE(KSTOR),DTPUMP(KSTOR)
  602 FORMAT('0', 15X, 'NO, TIMESTEPS PUMPED AFTER STORM, TO EMPTY, =',
     *                F12,2, /,
     *        ' ', 15X, 'TOTAL NO, TIMESTEPS OUTFLOW WAS PUMPED      =',
     *                F12,2 )
C
C                    Z) ALL OUTLETS
C
 8000 CONTINUE
      WRITE(6,603)   APLAN(KSTOR),STORMX(KSTOR),CPACRE(KSTOR),
     *               CLAND(KSTOR),CPCUYD(KSTOR),CSTOR(KSTOR),CPS(KSTOR),
     *               CTOTAL(KSTOR)
  603 FORMAT(' ', 15X, 'PLAN AREA OF RESERVOIR (LAND REQUIREMENT)   =',
     *                F12,2, ' SQ,FT,', /,
     *        ' ', 15X, 'MAX, STORAGE VOLUME USED (CONSTRUC, REQT,)  =',
     *                F12,2, ' CU,FT,', /,
     *        '0', 15X, 'COST OF LAND, AT $',F7,0,'/ACRE , , , , , ,= $',
     *                F12,2, /,
     *        ' ', 15X, 'COST OF RESERVOIR, AT $',F5,2,
     *                ' /CU,YD, , , ,= $',F12,2, /,
     *        ' ', 15X, 'COST OF PUMP STN. + SPECIAL STRUCTURES . .= $'.
     *            F12,2, /,
     *        '0', 15X, 'TOTAL COST', 32X, '= $', F12,2)
C
 9000 CONTINUE
      GC TO 9999
C
C------------------- ERROR MESSAGES ------------------------------------
C
C
  901 WRITE(6,691)  ISTOUT(KSTOR), KSTOR
  691 FORMAT('0 *** ISTOUT =', I3, ', IN RESERVOIR NO,', I4,
     *        ', IS OF A TYPE NOT PRESENTLY MODELED')
      STOP
C
  902 WRITE(6,692)
  692 FORMAT('0', 10X, '***  UNIT FLOODED, SO SUMMARY IS INVALID')
C
 9999 RETURN
      END
*DECK,NEWTON
      SUBROUTINE NEWTON(ALPHA,PS,C11,C2,KFLAG)
C======================================================================
C     NEWTON-RAPHSON ITERATION ASSUMING FUNCTIONAL FORM FOR Q-A CURVE,
      DIMENSION QI(160),QO(160)
C****     COMMON AREAS NAMES AND TABLES HAVE BEEN DELETED FROM THIS
C****     ROUTINE SINCE THEY WERE NOT BEING USED BY THIS ROUTINE
C****     DONE BY TS OF EH%A ON  1/25/76     **********************
      COMMON A(160,2,2),Q(160,2,2),CPOL1(160,2,5),CPOL2(160,2,5),QMAX(16
     10),     QFULL(160), AFULL(160), DXDT(160),C1(160), SLOPE(160),
     2        DIST(160), GEOM1(160), ROUGH(160), NOE(160), NUE(160,3),
     3        INUE(160,3), NTYPE(160), JR(160), NKLASS, NE, NDT, EPSIL,
     4        TIME, DT, M, KFULL, N, NOS, NPOLL, NPRINT, ITER,
     5        QDWF(160), IOLD(160), P1(160), RNOFF(160), QINFIL(160),
     6        WDWF(160,5), PLUTO(160,5), IR(160), P2(160), NIN(1000),
     7        P5(160),P6(160),P7(160),SCF(160),BARREL(160),
     8        TITLE(40), NPE(20), NYN(20), NORDER(70), GEOM2(160),
     9        GEOM3(160) , P4(160),SCOUR(160), KSTORE(160)
      COMMON  BODIN( 2,150),SSIN( 2,150),BODOUT,SSOUT,COLIN(2,150),
     *  QINST,QOUST,QINSTL( 2),QOUSTL( 2),STORL( 2),QOUTO( 2),STORO( 2),
     *  NSTOR,KSTOR,IPRINT( 2),IPOL( 2),IFLOOD( 2),ICOST( 2),DEPMAX( 2),
     *  ATERM( 2,11),AO2DT2( 2,11),BDEPTH( 2,11),BSTOR( 2,11),COLOUT,
     *  DUMSTR(11),DUMDEP(11),
     *  KTSTEP,VOLIN( 2,150),VOLOUT( 2,150),STOR,CUMIN( 2),CUMOUT( 2),
     *  SBOD( 2),SSS( 2),SCOL( 2),
     *  ISTMOD( 2),ISTTYP( 2),ISTOUT( 2),
     *  QPUMP( 2),DSTART( 2),DSTOP( 2),
     *  DTON( 2),STORMX( 2),DTPUMP( 2),DTMORE( 2),STORF( 2),APLAN( 2),
     *  CLAND( 2),CSTOR( 2),CPS( 2),CTOTAL( 2),CPCUYD( 2),CPACRE( 2),
     *  LP,JP,LPREV( 2),LABEL,DETENT(150),FRAC(150),OUT1(10,200)
      EQUIVALENCE (QO(1),Q(1,2,2)),(QI(1),Q(1,1,2))
C     FIRST GUESS FOR ALPHA ASSIGNED IN CALLING PROGRAM,
      KFLAG = 1
      HELP = 0,0
      ICHK = 0
      I = 0
   10 I=I+1
      PS = PSI(ALPHA)
      D=(PS+C11*ALPHA+C2)/(DPSI(ALPHA)+C11)
      IF (ABS(D),LE,EPSIL) GO TO 20
      ALPHA = ALPHA-D
      IF (ALPHA,LT.0,0.OR,ALPHA,GT.1.0.OR,ICHK.EQ.1) GO TO 15
      IF (I.LE,20) GO TO 10
      ALPHA = ALPHA+D/2,0
      ICHK = 1
      GO TO 10
C     IF NEED BE, ASSIGN NEW VALUES TO ALPHA BY MARCHING ALONG ABSCISSA.
```

```
   15 ALPHA = HELP
      HELP = HELP+0,05
      I = 0
      ICHK = 0
      IF (HELP,LE,1,05) GO TO 10
C     ITERATION DOES NOT CONVERGE, RETURN TO MAIN FOR ERROR MESSAGE,
      KFLAG = 2
      RETURN
   20 IF (ALPHA,GE,0,0,AND,ALPHA,LE,1,0) RETURN
      GO TO 15
      END
*DECK,FINDA
      SUBROUTINE FINDA(PS,AA)
C======================================================================
C     CALCULATES THE FLOW AREA IN CONDUITS GIVEN THE FLOW RATE,
      COMMON/TABLES/ KDEPTH(35),KLASS(35),PSIMAX(25),ALFMAX(25),NN(35),
     1               MM(35),ANORM(25,51),QNORM(25,51),DNORM(25,51),
     2   AFACT(25),  RFACT(25)
      COMMON A(160,2,2),Q(160,2,2),CPOL1(160,2,5),CPOL2(160,2,5),QMAX(16
     10),     QFULL(160), AFULL(160), DXDT(160),C1(160), SLOPE(160),
     2        DIST(160), GEOM1(160), ROUGH(160), NOE(160), NUE(160,3),
     3        INUE(160,3), NTYPE(160), JR(160), NKLASS, NE, NDT, EPSIL,
     4        TIME, DT, M, KFULL, N, NOS, NPOLL, NPRINT, ITER,
     5        QDWF(160), IOLD(160), P1(160), RNOFF(160), QINFIL(160),
     6        WDWF(160,5), PLUTO(160,5), IR(160), P2(160), NIN(1000),
     7        P5(160),P6(160),P7(160),SCF(160),BARREL(160),
     8        TITLE(40), NPE(20), NYN(20), NORDER(70), GEOM2(160),
     9        GEOM3(160) , P4(160),SCOUR(160), KSTORE(160)
      COMMON  BODIN( 2,150),SSIN( 2,150),BODOUT,SSOUT,COLIN(2,150),
     *  QINST,QOUST,QINSTL( 2),QOUSTL( 2),STORL( 2),QOUTO( 2),STORO( 2),
     *  NSTOR,KSTOR,IPRINT( 2),IPOL( 2),IFLOOD( 2),ICOST( 2),DEPMAX( 2),
     *  ATERM( 2,11),AO2DT2( 2,11),BDEPTH( 2,11),BSTOR( 2,11),COLOUT,
     *  DUMSTR(11),DUMDEP(11),
     *  KTSTEP,VOLIN( 2,150),VOLOUT( 2,150),STOR,CUMIN( 2),CUMOUT( 2),
     *  SBOD( 2),SSS( 2),SCOL( 2),
     *  ISTMOD( 2),ISTTYP( 2),ISTOUT( 2),
     *  QPUMP( 2),DSTART( 2),DSTOP( 2),
     *  DTON( 2),STORMX( 2),DTPUMP( 2),DTMORE( 2),STORF( 2),APLAN( 2),
     *  CLAND( 2),CSTOR( 2),CPS( 2),CTOTAL( 2),CPCUYD( 2),CPACRE( 2),
     *  LP,JP,LPREV( 2),LABEL,DETENT(150),FRAC(150),OUT1(10,200)
      AA = 0,0
      IF (PS,EQ,0,0) RETURN
      NT = NTYPE(M)
      IF (KLASS(NT),EQ,1) GO TO 150
C     CONDUITS WITH TABULAR Q-A RELATIONSHIP,
      MMM = MM(NT)
      DALPHA = ANORM(NT,2)-ANORM(NT,1)
      DO 110 I=1,MMM
      IF (PS-QNORM(NT,I+1)) 107,108,110
  107 ALPHA = ANORM(NT,I)+(PS-QNORM(NT,I))/(QNORM(NT,I+1)-QNORM(NT,I))*
     1DALPHA
      GO TO 111
  108 ALPHA = ANORM(NT,I+1)
      GO TO 111
  110 CONTINUE
  111 AA = ALPHA*AFULL(M)
      RETURN
C     CONDUITS WITH FUNCTIONAL Q-A RELATIONSHIP,
  150 C2 = -PS
      ALPHA=0,2
      CALL NEWTON(ALPHA,PS,0,0,C2,KFLAG)
      IF (KFLAG,EQ,2) GO TO 155
      AA = ALPHA*AFULL(M)
      RETURN
  155 WRITE (6,910) TIME,N,NOE(M),A(M,1,1)
      AA = A(M,1,1)
      RETURN
  910 FORMAT (/' **WARNING: NEWTON UNABLE TO FIND AREA GIVEN FLOW, TIME=
     1'F7,1,', TIME STEP='I3,', EXT, ELE, NUM,='I4,', USE OLD UPSTREAM A
     2REA='F6,2)
      END
*DECK,TSTORG
      SUBROUTINE TSTORG
C==============================================================
C****    COMMON AREA TABLES REMOVED FROM THIS ROUTINE SINCE IT WAS NOT
C****    BEING USED
C****    DONE BY TS OF EH%A ON  1/25/76       **********************
      COMMON A(160,2,2),Q(160,2,2),CPOL1(160,2,5),CPOL2(160,2,5),QMAX(16
     10),     QFULL(160), AFULL(160), DXDT(160),C1(160), SLOPE(160),
     2        DIST(160), GEOM1(160), ROUGH(160), NOE(160), NUE(160,3),
     3        INUE(160,3), NTYPE(160), JR(160), NKLASS, NE, NDT, EPSIL,
     4        TIME, DT, M, KFULL, N, NOS, NPOLL, NPRINT, ITER,
     5        QDWF(160), IOLD(160), P1(160), RNOFF(160), QINFIL(160),
     6        WDWF(160,5), PLUTO(160,5), IR(160), P2(160), NIN(1000),
     7        P5(160),P6(160),P7(160),SCF(160),BARREL(160),
     8        TITLE(40), NPE(20), NYN(20), NORDER(70), GEOM2(160),
     9        GEOM3(160) , P4(160),SCOUR(160), KSTORE(160)
      COMMON  BODIN( 2,150),SSIN( 2,150),BODOUT,SSOUT,COLIN(2,150),
     *  QINST,QOUST,QINSTL( 2),QOUSTL( 2),STORL( 2),QOUTO( 2),STORO( 2),
     *  NSTOR,KSTOR,IPRINT( 2),IPOL( 2),IFLOOD( 2),ICOST( 2),DEPMAX( 2),
     *  ATERM( 2,11),AO2DT2( 2,11),BDEPTH( 2,11),BSTOR( 2,11),COLOUT,
     *  DUMSTR(11),DUMDEP(11),
     *  KTSTEP,VOLIN( 2,150),VOLOUT( 2,150),STOR,CUMIN( 2),CUMOUT( 2),
     *  SBOD( 2),SSS( 2),SCOL( 2),
     *  ISTMOD( 2),ISTTYP( 2),ISTOUT( 2),
     *  QPUMP( 2),DSTART( 2),DSTOP( 2),
     *  DTON( 2),STORMX( 2),DTPUMP( 2),DTMORE( 2),STORF( 2),APLAN( 2),
     *  CLAND( 2),CSTOR( 2),CPS( 2),CTOTAL( 2),CPCUYD( 2),CPACRE( 2),
     *  LP,JP,LPREV( 2),LABEL,DETENT(150),FRAC(150),OUT1(10,200)
C
      DIMENSION  DEPTHL( 2),QI(160),QO(160),PUMP(2)
      DIMENSION QO1(160),QO2(160),SURGE1(160),SURGE2(160),DUMAO2(11)
      EQUIVALENCE (QO(1),Q(1,2,2)),(QI(1),Q(1,1,2))
      EQUIVALENCE (PUMP(1),DIST(1)),(SURGE1(1),P1(1)),(SURGE2(1),P2(1))
      EQUIVALENCE (QO1(1),QMAX(1)),(QO2(1),QFULL(1))
C
C
      IF (KTSTEP ,GT, 1)  GO TO 1300
      NZZ = 0
      IBYFLW = 0
C
      DO 1050 KSTDUM = 1, NSTOR
      IF (IPRINT(KSTDUM),GT,0) GO TO 1100
 1050 CONTINUE
      GO TO 1200
C
 1100 WRITE (6,601) NDT
  601 FORMAT ('1STORAGE SOLUTION FOR',I4,' TIME-STEPS FOLLOWS',
     *        ', ON A STEP-BY-STEP BASIS',//)
      IF (NPOLL,GT,0) WRITE (6,602)
  602 FORMAT('0U STP TIME INFLOW OUTFLOW  STORAGE DEPTH', 2X, 'IN: BOD',
     *         5X, 'SS STOR: BOD', 7X, 'SS', 4X, 'BOD', 5X, 'SS OUT: BOD',
     *         5X, 'SS', 4X, 'BOD', 5X, 'SS', 2X, ' J   L', /,
     *         ' N NO (MIN)  (CFS)  (CFS)   (CU,FT) (FT,)', 5X,
     *         '(LB)   (LB)', 6X, '(LB)', 5X, '(LB) (MG/L) (MG/L)', 5X,
     *         '(LB)   (LB) (MG/L) (MG/L)', 2X, ' P   P', /)
      IF (NPOLL,LT.1) WRITE (6,6002)
 6002 FORMAT('0U STP TIME INFLOW OUTFLOW  STORAGE DEPTH',/,' N NO (MIN)
     1 (CFS)  (CFS)  (CU,FT) (FT,)',/)
C
C     INITALIZE AT BEGINNING OF SIMULATION
C
```

```
 1200 DO 1250 KSTDUM = 1, NSTOR
         STORMX(KSTDUM) = 0,0
         LPREV(KSTDUM)  = 1
         SBOD(KSTDUM)   = 0,0
         SSS(KSTDUM)    = 0.0
         SCOL(KSTDUM)   = 0,0
         STOR   = STORO(KSTDUM)
         QINSTL(KSTDUM) = 0,0
         QOUSTL(KSTDUM) = QOUTO(KSTDUM)
         STORL(KSTDUM)  = STORO(KSTDUM)
         CUMIN(KSTDUM)  = 0,0
         CUMOUT(KSTDUM) = 0,0
         DTON(KSTDUM)   = 0,0
         LP      = 0
         JP      = 0
      REMMAX = 0,0
      SSRM = 0,000348
      BDCONC = 0,0
      SSCONC = 0,0
      COCONC = 0,0
      TBDOUT = 0,0
      TSSOUT = 0,0
      TCOOUT = 0,0
      DO 1230  I=1,11
        DUMSTR(I) = BSTOR(KSTDUM,I)
 1230   DUMDEP(I) = BDEPTH(KSTDUM,I)
C
      CALL TINTRP(DUMSTR,DUMDEP,11,STOR,DEPTH,KFLAG)
C
      IF (KFLAG ,EQ, -10)  GO TO 901
      IF (KFLAG ,EQ,  10)  GO TO 902
C
        DEPTHL(KSTDUM) = DEPTH
      IF (DEPTH,GT,DEPMAX(KSTDUM)) GO TO 902
      IF (IPRINT(KSTDUM),LT,1) GO TO 1250
      WRITE (6,603) KSTDUM, QOUTO(KSTDUM), STORO(KSTDUM), DEPTH
  603 FORMAT (' ', I1, '  0   0,0     0,0', F7,1, F10,0, F6,2)
 1250 CONTINUE
      WRITE(6,604)
  604 FORMAT('   ')
C------------
C     INITIALIZE EACH TIME STEP
C
 1300 DO 1350  I=1,11
        DUMSTR(I) = BSTOR(KSTOR,I)
        DUMDEP(I) = BDEPTH(KSTOR,I)
      IF(ISTOUT(KSTOR),EQ,5,OR,ISTOUT(KSTOR),EQ,6) GO TO 1350
      DUMSTR(I) = ATERM(KSTOR,I)
      DUMDEP(I) = AO2DT2(KSTOR,I)
 1350 CONTINUE
        RKTSTP = KTSTEP
        TIME2M = DT*RKTSTP/60,0
        BODOUT = 0.0
        SSOUT = 0,0
        COLOUT = 0.0
      BYFLOW = 0,0
      QBYPAS = 0,0
      BODBYP = 0,0
      SUSBYP = 0,0
      COLBYP = 0,0
      VOLIN(KSTOR,KTSTEP) = 0,0
      VOLOUT(KSTOR,KTSTEP) = 0,0
C
C
 2100   VOLIN(KSTOR,KTSTEP) = 0,5*DT*(QINSTL(KSTOR) + QINST)
        VOLOUZ = DT*QOUSTL(KSTOR)
      IF (ISTOUT(KSTOR),NE,5,AND,ISTOUT(KSTOR),NE,6) VOLOUZ = VOLOUZ*0,5
        STORZ  = STORL(KSTOR) + VOLIN(KSTOR,KTSTEP) - VOLOUZ
      TSTORZ = STORZ
      IF(STORZ,LE,1.0E-10) STORZ = 0,0
C
      IF (STORZ,GT,DUMSTR(11)) STORZ = DUMSTR(11)
      CALL TINTRP(DUMSTR,DUMDEP,11,STORZ,DUMMYY,KFLAG)
C
      IF (KFLAG ,EQ, -10)  GO TO 901
      IF (KFLAG ,EQ,  10)  GO TO 902
C
C     CHECK FOR TYPE OF STORAGE OUTFLOW -- PUMPING OR GRAVITY FLOW
C
      IF(ISTOUT(KSTOR),NE.5,AND,ISTOUT(KSTOR),NE,6) GO TO 3000
C
C     OUTFLOW FROM STORAGE BY FIXED RATE PUMPS
C
      IF(ISTOUT(KSTOR),EQ,6) GO TO 2150
      IF(NZZ,NE,1,OR,DUMMYY,GT,DSTOP(KSTOR)*2,0) GO TO 2120
      QPUMP(KSTOR) = QPUMP(KSTOR)/2,0
      QOUSTL(KSTOR) = QPUMP(KSTOR)
      NZZ = 0
      WRITE(6,6005) QPUMP(KSTOR)
 6005 FORMAT(/,' * * * * *  PUMPING RATE SET BACK TO INITIAL VALUE OF',
     1F7,1,' CFS  * * * * *',/)
 2120 IF(DSTART(KSTOR)+0.5,GE,DUMMYY,OR,NZZ,EQ,1,OR,QINST+1.5,LE,QPUMP(
     *KSTOR))GO TO 2150
      NZZ = 1
      QPUMP(KSTOR) = QPUMP(KSTOR) * 2,0
      QOUSTL(KSTOR) = QPUMP(KSTOR)
      FON = (QINST - QPUMP(KSTOR))/(QINST -QINSTL(KSTOR))
        DTON(KSTOR)    = DTON(KSTOR) + FON
      WRITE(6,605) QPUMP(KSTOR)
  605 FORMAT(/,' * * * * *  INITIAL PUMPING RATE DOUBLE TO',F7,1,' CFS U
     1NTIL DEPTH IS TWICE DSTOP(KSTOR)  * * * * *',/)
C
 2150 IF (QOUSTL(KSTOR) ,EQ, 0,0 ,AND, DUMMYY ,GT, DSTART(KSTOR))
     *  GO TO 2200
      IF (QOUSTL(KSTOR) ,GT, 0,0 ,AND, DUMMYY ,LT, DSTOP(KSTOR) )
     *  GO TO 2300
        QOUST  = QOUSTL(KSTOR)
        VOLOUT(KSTOR,KTSTEP) = QOUST * DT
      STOR = STORL(KSTOR) + VOLIN(KSTOR,KTSTEP) - VOLOUT(KSTOR,KTSTEP)
        DEPTH  = DUMMYY
      GO TO 3200
C
 2200 FON = (DUMMYY - DSTART(KSTOR)) / (DUMMYY - DEPTHL(KSTOR))
        QOUST  = QPUMP(KSTOR)
      GO TO 2400
C
 2300 FON = (DEPTHL(KSTOR) - DSTOP(KSTOR)) / (DEPTHL(KSTOR) - DUMMYY)
        QOUST  = 0,0
C
 2400 IF (FON ,LT, 0,0)  GO TO 8100
        VOLOUT(KSTOR,KTSTEP) = FON*DT*QPUMP(KSTOR)
        STOR   = STORL(KSTOR) + VOLIN(KSTOR,KTSTEP)-VOLOUT(KSTOR,KTSTEP)
      GO TO 3100
C------------
C
C
C     OUTFLOW FROM STORAGE BY GRAVITY FLOW
C
 3000 QOUST = DUMMYY / (DT*0.5)
      VOLOUT(KSTOR,KTSTEP) = .5 * (QOUST + QOUSTL(KSTOR)) * DT
      IF (VOLOUT(KSTOR,KTSTEP),LT,100) VOLOUT(KSTOR,KTSTEP) = 0,0
      STOR = TSTORZ - DUMMYY
 3100 DO 3101 I = 1,11                                                  TST0193
      DUMSTR(I) = BSTOR(KSTOR,I)                                        TST0194
 3101 DUMDEP(I) = BDEPTH(KSTOR,I)                                       TST0195
      IF(STOR,LE,1,0E-1) STOR = 0,0                                     TST0196
      SDUMMY = STOR                                                     TST0197
      IF (STOR,GT,DUMSTR(11)) SDUMMY = DUMSTR(11)                       TST0198
      CALL TINTRP(DUMSTR,DUMDEP,11,SDUMMY,DEPTH,KFLAG)                  TST0199
C                                                                       TST0200
      IF (KFLAG ,EQ, -10)  GO TO 901                                    TST0201
      IF (KFLAG ,EQ,  10)  GO TO 902                                    TST0202
C                                                                       TST0203
 3200 DEPTHL(KSTOR) = DEPTH                                             TST0204
      IF (QOUST,GT,0,0) DTON(KSTOR) = DTON(KSTOR) + 1,0                 TST0205
C                                                                       TST0206
C     FLOW THROUGH ORIFICE AND WEIR                                     TST0207
C                                                                       TST0208
      IF (ISTOUT(KSTOR),NE,9) GO TO 3300                                TST0209
      SDUMMY = STOR                                                     TST0210
      IF (STOR,GT,DUMSTR(11)) SDUMMY = DUMSTR(11)                       TST0211
      DO 3305 II = 1, 11                                                TST0212
 3305 DUMAO2(II) = OUT1(KSTOR,II)                                       TST0213
      CALL TINTRP(DUMSTR,DUMAO2,11,SDUMMY,O2DT2,KFLAG)                  TST0214
      IF (KFLAG,EQ,-10) GO TO 901                                       TST0215
      IF (KFLAG,EQ, 10) GO TO 902                                       TST0216
      QO1(M) = O2DT2/(DT*0,5)                                           TST0217
      QO2(M) = QOUST-QO1(M)                                             TST0218
      IF (QO2(M),LT,0,01) QO2(M) = 0,0                                  TST0219
C                                                                       TST0220
C     CHECK IF STORAGE CAPACITY HAS BEEN EXCEEDED                       TST0221
C                                                                       TST0222
 3300 IF (STOR,LT,BSTOR(KSTOR,11)) GO TO 4000                           TST0223
C                                                                       TST0224
C     COMPUTE VOLUME BY WHICH STORAGE IS EXCEEDED - BYFLOW              TST0225
C                                                                       TST0226
      XXSTOR = STOR                                                     TST0227
      STOR = BSTOR(KSTOR,11)                                            TST0228
      BYFLOW = XXSTOR - STOR                                            TST0229
      IBYFLW = IBYFLW + 1                                               TST0230
      NEE = NE + 1                                                      TST0231
      DO 3201 IX = 1, 3                                                 TST0232
      IXM = 4 - IX                                                      TST0233
      IF (INUE(M,IXM),NE,NEE) GO TO 3202                                TST0234
 3201 CONTINUE                                                          TST0235
      GO TO 3210                                                        TST0236
 3202 BYFLOW = BYFLOW / IXM                                             TST0237
C                                                                       TST0236
C     STORE BYFLOW VOLUME IN NEXT UPSTREAM NON-CONDUIT                  TST0239
C                                                                       TST0240
      DO 3203 IX = 1, IXM                                               TST0241
      MU = INUE(M,IXM)                                                  TST0242
C****     NEXT CARD CHANGED BY TS OF EH%A ON  1/25/76          *************
      IF (NTYPE(MU),GE,26) GO TO 3203                                   TST0243
      MU = INUE(MU,1)                                                   TST0244
 3203 SURGE2(MU) = SURGE2(MU) + BYFLOW                                  TST0245
 3210 IF(IBYFLW,EQ,1) WRITE(6,666)                                      TST0246
  666 FORMAT (//,                                                       TST0247
     *'     *********************************************************',/TST0248
     *'     *********  STORAGE UNIT IN TRANSPORT IS FLOODING  *********',/TST0249
     *'     *** EXCESS WATER IS BEING STORED IN UPSTREAM ELEMENT  ***',/TST0250
     *'     *********************************************************') TST0251
C                                                                       TST0252
C                                                                       TST0253
C                     COMPUTE SEDIMENT AND BOD OUTFLOW                  TST0254
C                                                                       TST0255
C                                                                       TST0256
C                     DETERMINE PLUG FRACTIONS AND DETENTION TIMES      TST0257
```

```
C
C                   SSIN   = SS INFLOW (LB) IN THIS TIME-STEP
C                   BODIN  = BOD INFLOW (LB) IN THIS TIME-STEP
C                   SBOD(KSTOR)   = BOD (LB) IN RESERVOIR
C                   SSS(KSTOR)    = SS  (LB) IN RESERVOIR
C                   BODOUT = BOD OUTFLOW (LB)
C                   SSOUT, SSOUT = SS  OUTFLOW (LB)
C                   BODCOT = BOD OUTFLOW CONC, (MG/L)
C                   SSCOUT = SS  OUTFLOW CONC, (MG/L)
C                   SBOD(KSTOR)C  = BOD CONC, (MG/L) AVG, IN RESERVOIR
C                   SSS(KSTOR)C   = SS  CONC, (MG/L) AVG, IN RESERVOIR
C                   MG/L   = 16050*(LB/CU,FT,)
C
C
C
C
C                   NOW HAVE, FOR EACH PLUG (FOR KP=JP,LP), ,,
C                        FRAC(KP),DETENT(KP)
C
C                   MODEL ASSUMES,,
C                        NO SCOUR WITHIN BASIN
C
C                   BRANCH FOR TYPE OF BASIN FLOW (IPOL(KSTOR))
C
 4000 IF(IPOL(KSTOR),EQ,0) GO TO 4400
      IF(IPOL(KSTOR),NE,1) GO TO 4180
C
C     PLUG FLOW ROUTINE - UP TO STATEMENT 4180
C
      CALL TPLUGS
      SSOUT = 0,0
      BODOUT = 0,0
      COLOUT = 0,0
      IF (VOLOUT(KSTOR,KTSTEP),GT,1.0) GO TO 4100
      SSCOUT = 0,0
      BODCOT = 0,0
      COLCOT = 0,0




      GO TO 4160
 4100 LLLPR = LPREV(KSTOR)
      IF (JP,EQ,0) JP = 1
      DO 4150 KP = JP,LLLPR
      PCREM = REMMAX*(1,0 - EXP(-SSRM*DETENT(KP)))
      SSLEFT = 1,0 - PCREM
      BODLFT = 1,0 - 0,55*PCREM
      SSOUT = SSOUT + SSIN(KSTOR,KP)*FRAC(KP)*SSLEFT
      BODOUT = BODOUT + BODIN(KSTOR,KP)*FRAC(KP)*BODLFT
 4150 COLOUT = COLOUT + COLIN(KSTOR,KP)*FRAC(KP)
      SSCOUT = SSOUT*16050,0/VOLOUT(KSTOR,KTSTEP)
      BODCOT = BODOUT*16050,0/VOLOUT(KSTOR,KTSTEP)
      COLCOT = COLOUT/(283,2*VOLOUT(KSTOR,KTSTEP))
 4160 TBDOUT = TBDOUT + BODOUT
      TSSOUT = TSSOUT + SSOUT
      TCOOUT = TCOOUT + COLOUT
      IF (STOR,LE,1,0E-1) GO TO 4161
      SBOD(KSTOR) = SBOD(KSTOR) + BODIN(KSTOR,KTSTEP) - BODOUT
      SSS(KSTOR) = SSS(KSTOR) + SSIN(KSTOR,KTSTEP) - SSOUT
      SCOL(KSTOR) = SCOL(KSTOR) + COLIN(KSTOR,KTSTEP) - COLOUT
      SBODC = SBOD(KSTOR)*16050,0/STOR
      SSSC = SSS(KSTOR)*16050,0/STOR
      SCOLC = SCOL(KSTOR)/(283,2*STOR)
      IF (SBOD(KSTOR),LT,0,1) SBOD(KSTOR) = 0,0
      IF (SSS(KSTOR),LT,0,1) SSS(KSTOR) = 0,0
      IF (SCOL(KSTOR),LT,0,1) SCOL(KSTOR) = 0,0
      IF (SBODC,LT,0,1) SBODC = 0,0
      IF (SSSC,LT,0,1) SBODC = 0,0
      IF (SCOLC,LT,0,1) SCOLC = 0,0
      GO TO 4400
 4161 SBOD(KSTOR) = 0,0
      SSS(KSTOR) = 0,0
      SCOL(KSTOR) = 0,0
      SBODC = 0,0
      SSSC  = 0,0
      SCOLC = 0,0
      STOR = 0,0
      GO TO 4400
C
C     PERFECT MIXING ROUTINE - THROUGH STATEMENT 4400
C
 4180 AVGQ = 0,5*(VOLIN(KSTOR,KTSTEP) + VOLOUT(KSTOR,KTSTEP))
      IF (AVGQ,GT,0,01) GO TO 4181
      BODOUT = 0,0
      SSOUT = 0,0
      COLOUT = 0,0
      BODCOT = 0,0
      SSCOUT = 0,0
      COLCOT = 0,0
      GO TO 4400
 4181 IF (STOR,GT,1,0E-1) GO TO 4182
      SSCONC = 0,0
      BDCONC = 0,0
      COCONC = 0,0
      STOR = 0,0
      GO TO 4185
 4182 DETIME = STOR/AVGQ
C
C     REMMAX = 0,0 -- NO POLLUTANT REMOVAL WITHIN STORAGE UNIT
C                     COMPLETE SCOUR ASSUMED
C
      PCREM = REMMAX*(1,0 - EXP(-SSRM*DETIME))
      SREMK = PCREM/DETIME
C
C     COMPUTE SS CONCENTRATION IN STORAGE UNIT
C
      CONCIN = 0,0
      IF(VOLIN(KSTOR,KTSTEP),GE,1,0E-5) CONCIN= SSIN(KSTOR,KTSTEP) * 160
     *50,0 / VOLIN(KSTOR,KTSTEP)
      ACONC = 2,0*VOLIN(KSTOR,KTSTEP)*CONCIN
      BCONC = 2,0*STOR*SSCONC
      CCONC = VOLOUT(KSTOR,KTSTEP)*SSCONC
      DCONC = SREMK*STOR*DT*SSCONC
      ECONC = 2,0*STOR + VOLOUT(KSTOR,KTSTEP)
      FCONC = SREMK*STOR*DT
      SSCONC = (ACONC +BCONC -CCONC - DCONC)/(ECONC + FCONC)
      BREMK = 0,55*SREMK
```

```
C
C     COMPUTE BOD CONCENTRATION IN STORAGE UNIT
C
      CONCIN = 0,0
      IF(VOLIN(KSTOR,KTSTEP).GE,1,0E-5) CONCIN=BODIN(KSTOR,KTSTEP) * 160
     *50,0 / VOLIN(KSTOR,KTSTEP)
      ACONC = 2,0*VOLIN(KSTOR,KTSTEP)*CONCIN
      BCONC = 2,0*STOR*BDCONC
      CCONC = VOLOUT(KSTOR,KTSTEP)*BDCONC
      DCONC = BREMK*STOR*DT*BDCONC
      ECONC = 2,0*STOR + VOLOUT(KSTOR,KTSTEP)
      FCONC = BREMK*STOR*DT
      BDCONC = (ACONC +BCONC -CCONC - DCONC)/(ECONC + FCONC)
C
C     COMPUTE COLIFORM CONCENTRATION IN STORAGE UNIT
C
      COLCIN = 0,0
      IF(VOLIN(KSTOR,KTSTEP),GE.1.0E-5) COLCIN=COLIN(KSTOR,KTSTEP) / (VO
     *LIN(KSTOR,KTSTEP) * 283,2)
      COCONC = (COLCIN*VOLIN(KSTOR,KTSTEP) + COCONC*(STOR - VOLOUT(KSTOR
     *,KTSTEP)))/STOR
 4185 IF (SSCONC,GE,0,0) GO TO 4186
      SSCONC = 0,0
      BDCONC = 0,0
      COCONC = 0,0
C
C     CONVERT CONCENTRATIONS OF POLLUTANT OUTFLOWS TO QUANTITIES
C
 4186 SSCOUT = SSCONC
      SSOUT = SSCONC*VOLOUT(KSTOR,KTSTEP)/16050,0
      BODCOT = BDCONC
      BODOUT = BDCONC*VOLOUT(KSTOR,KTSTEP)/16050,0
      COLCOT = COCONC
      COLOUT = COCONC*VOLOUT(KSTOR,KTSTEP)*283,2
      SSSC = 0,0
      SBODC = 0,0
      SCOLC = 0,0
      IF (STOR,LE,0.1) GO TO 4190
      SSSC = SSCONC
      SBODC = BDCONC
      SCOLC = COCONC
 4190 SSS(KSTOR) = SSSC*STOR/16050,0
      SBOD(KSTOR) = SBODC*STOR/16050,0
      SCOL(KSTOR) = SCOLC*STOR*283,2
      IF (VOLOUT(KSTOR,KTSTEP),GT,0,1) GO TO 4400
      SSOUT = 0,0
      BODOUT = 0,0
      COLOUT = 0,0
      SSCOUT = 0,0
      BODCOT = 0,0
      COLCOT = 0,0
C
 4400   QINSTL(KSTOR) = QINST
        QOUSTL(KSTOR) = QOUST
        STORL(KSTOR)  = STOR
C
C     TOTAL INFLOWS AND OUTFLOWS TO STORAGE UNIT
C
      CUMIN(KSTOR) = CUMIN(KSTOR) + VOLIN(KSTOR,KTSTEP) - BYFLOW
      CUMOUT(KSTOR) = CUMOUT(KSTOR) + VOLOUT(KSTOR,KTSTEP)
      IF (KTSTEP,EQ,NDT) STORF(KSTOR) = STOR
      IF (IPRINT(KSTOR),LT,1) GO TO 5300
      IF (IPOL(KSTOR),EQ,0) GO TO 5100
C
C                 PRINT SOLUTION FOR THIS TIME STEP
C
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 5000 WRITE(6,606)  KSTOR,KTSTEP,TIME2M,QINST,QOUST,                    TST0438
     *              STOR,DEPTH,BODIN(KSTOR,KTSTEP),SSIN(KSTOR,KTSTEP),  TST0439
     *              SBOD(KSTOR),SSS(KSTOR),SBODC,SSSC,BODOUT,SSOUT,     TST0440
     *              BODCOT,SSCOUT,JP,LP                                 TST0441
  606 FORMAT(' ', I1, I3, F6.1, 2F7.2, F10.0, F6.2, 2X, 2F7.2, F10.2,   TST0442
     *       F9.2, 2F7.1, F9.2,F7.2,2F7.1,2I4)                          TST0443
      WRITE(6,665) COLIN(KSTOR,KTSTEP),SCOL(KSTOR),SCOLC,COLOUT,COLCOT  TST0444
  665 FORMAT(' ', 40X, 'COLIN=', 1PE9.2, 'SCOL(MPN)=', E9.2,            TST0445
     *       'CONC=', E9.2, 'COLOUT=', E9.2, 'CONC=', E9.2)             TST0446
      GO TO 5200                                                        TST0447
 5100 WRITE(6,606)  KSTOR,KTSTEP,TIME2M,QINST,QOUST,STOR,DEPTH          TST0448
C                                                                       TST0449
 5200 IF (KSTOR.EQ.NSTOR) WRITE(6,604)                                  TST0450
 5300 IF (KSTOR.LT.NSTOR) GO TO 9999                                    TST0451
      IF (KTSTEP.LT.NDT) GO TO 9999                                     TST0452
      DO 5350 KSTDUM = 1, NSTOR                                         TST0453
      IF (IFLOOD(KSTDUM).EQ.1) GO TO 5350                               TST0454
      IF (IPRINT(KSTDUM).LT.1) GO TO 5350                               TST0455
      WRITE(6,607)  NDT, KSTDUM, CUMIN(KSTDUM), CUMOUT(KSTDUM)          TST0456
  607 FORMAT('0', /, ' ', 26X, 'FOR THESE', I4, ' TIME STEPS ',         TST0457
     *        'IN STORAGE UNIT NO.', I3,/,                              TST0458
     *        ' ', 36X, 'CUMULATIVE INFLOW  =', F12.0, ' CU.FT.', /,    TST0459
     *        ' ', 36X, 'CUMULATIVE OUTFLOW =', F12.0, ' CU.FT.')       TST0460
 5350 CONTINUE                                                          TST0461
       GO TO 9999                                                       TST0462
C                                                                       TST0463
C----------------- ERROR MESSAGES --------------------------------------TST0464
C                                                                       TST0465
 8100 WRITE(6,692)                                                      TST0466
  692 FORMAT(' ', 14X, 'BUFFER VOLUME BETWEEN LEVELS DSTART AND DSTOP ',TST0467
     *        'IS TOO SMALL,', /,                                       TST0468
     *        ' ', 14X, 'RESULTING IN NEGATIVE VOLOUT (AND FON).')      TST0469
      GO TO 9999                                                        TST0470
C                                                                       TST0471
  901 IF (KFLAG .EQ. 10)  GO TO 902                                     TST0472
      WRITE(6,693)                                                      TST0473
  693 FORMAT('0 *** TERMINATE - INPUT TO TINTRP PROCEDURE IS LESS THAN LTST0474
     *OWEST VALUE ON CURVE (IN SUBRT. TSTORG)')                         TST0475
C     STOP 901                                                          TST0476
      STOP 701
C                                                                       TST0477
  902 WRITE(6,694)                                                      TST0478
  694 FORMAT('0 *** TERMINATE - INPUT TO TINTRP PROCEDURE IS GREATER THATST0479
     *N LARGEST VALUE ON CURVE (IN SUBRT. TSTORG)')                     TST0480
C     STOP 902                                                          TST0481
      STOP 702
C                                                                       TST0482
 9999 RETURN                                                            TST0483
      END                                                               TST0484
*DECK,TINTRP
      SUBROUTINE TINTRP(X, Y, L, XE, YE, K)                             TINT  1
C=======================================================================TINT  2
      DIMENSION X(L),Y(L)                                               TINT  3
C                                                                       TINT  4
C                   GIVEN XE,  INTRPOLATES LINEARLY FOR YE              TINT  5
C                   FLAGS M/PROG WITH K-VALUE, IF XE OUTSIDE RANGE      TINT  6
C                   ( FROM MCCRACKEN, PP. 61-64 )                       TINT  7
C                                                                       TINT  8
      IF (XE .GE. X(1) )  GO TO 2000                                    TINT  9
C                                                                       TINT 10
C                   XE IS .LT. LOWEST VALUE ON CURVE                    TINT 11
 1000   K  = -10                                                        TINT 12
      GO TO 9999                                                        TINT 13
C                                                                       TINT 14
C                   SEARCH FOR SMALLEST X(J) .GT. XE                    TINT 15
 2000 DO 2050  J=2,L                                                    TINT 16
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      IF (XE-X(J) )  4000,3000,2050                                     TINT 17
 2050 CONTINUE                                                          TINT 18
C                   XE IS ,GT, LARGEST VALUE ON CURVE                   TINT 19
C                                                                       TINT 20
        K  = 10                                                         TINT 21
      GO TO 9999                                                        TINT 22
C                                                                       TINT 23
C                   XE COINCIDES WITH AN X(J), SO  INTRPOLATION UNNECESSTINT 24
 3000   YE = Y(J)                                                       TINT 25
      GO TO 5000                                                        TINT 26
C                                                                       TINT 27
C                   NOW X(J) IS THE SMALLEST VALUE ,GT, XE,             TINT 28
C                   COMPUTE YE BY LINEAR INTERPOLATION,                 TINT 29
C                                                                       TINT 30
 4000   YE = Y(J-1) + (Y(J)-Y(J-1))*(XE-X(J-1))/(X(J)-X(J-1))           TINT 31
 5000   K  = 0                                                          TINT 32
C                                                                       TINT 33
 9999 RETURN                                                            TINT 34
      END                                                               TINT 35
*DECK,TPLUGS
      SUBROUTINE TPLUGS                                                 TPLU  1
C=======================================================================TPLU  2
C****    COMMON AREA TABLES REMOVED FROM THIS ROUTINE SINCE IT WAS NOT
C****    BEING USED
C****    DONE BY TS OF EH%A ON  1/25/76      ************************
      COMMON A(160,2,2),Q(160,2,2),CPOL1(160,2,5),CPOL2(160,2,5),QMAX(16TPLU  6
     10),      QFULL(160), AFULL(160), DXDT(160),C1(160), SLOPE(160),   TPLU  7
     2         DIST(160), GEOM1(160), ROUGH(160), NOE(160), NUE(160,3), TPLU  8
     3         INUE(160,3), NTYPE(160), JR(160), NKLASS, NE, NDT, EPSIL, TPLU  9
     4         TIME, DT, M, KFULL, N, NOS, NPOLL, NPRINT, ITER,         TPLU 10
     5         QDWF(160), IOLD(160), P1(160), RNOFF(160), QINFIL(160),  TPLU 11
     6         WDWF(160,5), PLUTO(160,5), IR(160), P2(160), NIN(1000),  TPLU 12
     7         P5(160),P6(160),P7(160),SCF(160),BARREL(160),            TPLU 13
     8         TITLE(40), NPE(20), NYN(20), NORDER(70), GEOM2(160),     TPLU 14
     9         GEOM3(160) , P4(160),SCOUR(160), KSTORE(160)             TPLU 15
      COMMON  BODIN( 2,150),SSIN( 2,150),BODOUT,SSOUT,COLIN(2,150),     TPLU 16
     *  QINST,QOUST,QINSTL( 2),QOUSTL( 2),STORL( 2),QOUTO( 2),STORO( 2),TPLU 17
     *  NSTOR,KSTOR,IPRINT( 2),IPOL( 2),IFLOOD( 2),ICOST( 2),DEPMAX( 2),TPLU 18
     *  ATERM( 2,11),AO2DT2( 2,11),BDEPTH( 2,11),BSTOR( 2,11),COLOUT,   TPLU 19
     *  DUMSTR(11),DUMDEP(11),                                          TPLU 20
     *  KTSTEP,VOLIN( 2,150),VOLOUT( 2,150),STOR,CUMIN( 2),CUMOUT( 2),  TPLU 21
     *  SBOD( 2),SSS( 2),SCOL( 2),                                      TPLU 22
     *  ISTMOD( 2),ISTTYP( 2),ISTOUT( 2),                               TPLU 23
     *  QPUMP( 2),DSTART( 2),DSTOP( 2),                                 TPLU 24
     *  DTON( 2),STORMX( 2),DTPUMP( 2),DTMORE( 2),STORF( 2),APLAN( 2),  TPLU 25
     *  CLAND( 2),CSTOR( 2),CPS( 2),CTOTAL( 2),CPCUYD( 2),CPACRE( 2),   TPLU 26
     *  LP,JP,LPREV( 2),LABEL,DETENT(150),FRAC(150),OUT1(10,200)        TPLU 27
C                                                                       TPLU 28
      DIMENSION QO1(150),QO2(150)                                       TPLU 29
      EQUIVALENCE (QO1(1),QMAX(1)),(QO2(1),QFULL(1))                    TPLU 30
      KDT = KTSTEP                                                      TPLU 31
      IF (KDT,EQ,1) FRACR = 1,0                                         TPLU 32
      IF (KDT,EQ,1) IBIGPL =0                                           TPLU 33
      LABEL = 0                                                         TPLU 34
C     )")")")")")")")")")")")")")")")")")")")")")")")")")")")")")")")")"TPLU 35
C                                                                       TPLU 36
C     NO OUTFLOW -- SET POLLUTANTS TO ZERO FOR THIS TIME STEP            TPLU 37
      IF (VOLOUT(KSTOR,KDT),GT,0,0) GO TO 900                           TPLU 38
      LABEL = 5000                                                      TPLU 39
      RETURN
C     )")")")")")")")")")")")")")")")")")")")")")")")")")")")")")")")")"
C
C     SUM INFLOWS -- BRANCH WHEN TOTAL INFLOWS " OUTFLOW FOR THIS DT
  900 LP = KDT
      JP = LPREV(KSTOR)
      SUM = VOLIN(KSTOR,JP)*FRACR
      IF (VOLOUT(KSTOR,KDT),LT,SUM) GO TO 1200
      IF (JP,EQ,LP) GO TO 1025
      JPP1 = JP + 1
      DO 1000 L = JPP1, LP
      SUM = SUM + VOLIN(KSTOR,L)
      IF (VOLOUT(KSTOR,KDT),LT,SUM) GO TO 1100
 1000 CONTINUE
C     )")")")")")")")")")")")")")")")")")")")")")")")")")")")")")")")")"
C
C     SUM OF INFLOWS ) OR = OUTFLOW, SO EMPTY STORAGE
      LP = L - 1
 1025 FRAC(JP) = FRACR
      DETENT(JP) = (KDT - JP) * DT
      IF (JP,EQ,LP) GO TO 1075
      JPP1 = JP + 1
      DO 1050 L = JPP1, LP
      FRAC(L) = 1,0
 1050 DETENT(L) = (KDT - L)*DT
 1075 FRACR = 0,0
      LPREV(KSTOR) =LP
      IBIGPL = 0
      RETURN
C     )")")")")")")")")")")")")")")")")")")")")")")")")")")")")")")")")"
C
C     SUM OF INFLOWS " OUTFLOW -- REMOVE SOME PLUGS AND PART-PLUGS
 1100 FRAC(JP) = FRACR
      DETENT(JP) = (KDT - JP)*DT
      JPP1 = JP + 1
      IF (JPP1,EQ,L) GO TO 1175
      LM1 = L - 1
      DO 1150 LL = JPP1, LM1
      FRAC(LL) = 1.0
 1150 DETENT(LL) = (KDT - LL)*DT
 1175 FRACR = (SUM - VOLOUT(KSTOR,KDT))/VOLIN(KSTOR,L)
      FRAC(L) = 1,0 - FRACR
      DETENT(L) = (KDT - L)*DT
      LPREV(KSTOR) =L
      IBIGPL = 1
      RETURN
C     )")")")")")")")")")")")")")")")")")")")")")")")")")")")")")")")")"
C
C     ONE PLUG " OUTFLOW
C     IF ENTIRE PLUG IS IN STORAGE (IBIGPL = 0) REMOVE A PORTION
 1200 IF (IBIGPL,EQ,1) GO TO 1300
      FRACR = (VOLIN(KSTOR,JP) - VOLOUT(KSTOR,KDT))/VOLIN(KSTOR,JP)
      FRAC(JP) = 1,0 - FRACR
      DETENT(JP) = (KDT - JP)*DT
      LPREV(KSTOR) = JP
      IBIGPL = 1
      RETURN
C     )")")")")")")")")")")")")")")")")")")")")")")")")")")")")")")")")"
C
C     IF PART-PLUG HAS BEEN REMOVED DO NOT REMOVE AGAIN - FRAC NOT " 1
 1300 FRACRT = 1,0 - FRACR
      FRACR = (VOLIN(KSTOR,JP)*FRACR-VOLOUT(KSTOR,KDT))/VOLIN(KSTOR,JP)
      FRACL = FRACR + FRACRT
      FRAC(JP) = 1,0 - FRACL
      DETENT(JP) = (KDT - JP) * DT                                      TPLU104
      LPREV(KSTOR) = JP                                                 TPLU105
      IBIGPL = 1                                                        TPLU106
      RETURN                                                            TPLU107
      END                                                               TPLU108
*DECK,TSTRDT
      SUBROUTINE TSTRDT                                                 TSTR   1
C=======================================================================TSTR   2
C****    COMMON AREA TABLES REMOVED FROM THIS ROUTINE SINCE IT WAS NOT
C****    BEING USED
C****    DONE BY TS OF EH%A ON  1/25/76      ***********************
      COMMON A(160,2,2),Q(160,2,2),CPOL1(160,2,5),CPOL2(160,2,5),QMAX(16TSTR   6
     10),    QFULL(160), AFULL(160), DXDT(160),C1(160), SLOPE(160),     TSTR   7
     2       DIST(160), GEOM1(160), ROUGH(160), NOE(160), NUE(160,3),   TSTR   8
     3       INUE(160,3), NTYPE(160), JR(160), NKLASS, NE, NDT, EPSIL,  TSTR   9
     4       TIME, DT, M, KFULL, N, NOS, NPOLL, NPRINT, ITER,           TSTR  10
     5       QDWF(160), IOLD(160), P1(160), RNOFF(160), QINFIL(160),    TSTR  11
     6       WDWF(160,5), PLUTO(160,5), IR(160), P2(160), NIN(1000),    TSTR  12
     7       P5(160),P6(160),P7(160),SCF(160),BARREL(160),              TSTR  13
     8       TITLE(40), NPE(20), NYN(20), NORDER(70), GEOM2(160),       TSTR  14
     9       GEOM3(160) , P4(160),SCOUR(160), KSTORE(160)               TSTR  15
      COMMON  BODIN( 2,150),SSIN( 2,150),BODOUT,SSOUT,COLIN(2,150),     TSTR  16
     *  QINST,QOUST,QINSTL( 2),QOUSTL( 2),STORL( 2),QOUTO( 2),STORO( 2),TSTR  17
     *  NSTOR,KSTOR,IPRINT( 2),IPOL( 2),IFLOOD( 2),ICOST( 2),DEPMAX( 2),TSTR  18
     *  ATERM( 2,11),AO2DT2( 2,11),BDEPTH( 2,11),BSTOR( 2,11),COLOUT,   TSTR  19
     *  DUMSTR(11),DUMDEP(11),                                          TSTR  20
     *  KTSTEP,VOLIN( 2,150),VOLOUT( 2,150),STOR,CUMIN( 2),CUMOUT( 2),  TSTR  21
     *  SBOD( 2),SSS( 2),SCOL( 2),                                      TSTR  22
     *  ISTMOD( 2),ISTTYP( 2),ISTOUT( 2),                               TSTR  23
     *  QPUMP( 2),DSTART( 2),DSTOP( 2),                                 TSTR  24
     *  DTON( 2),STORMX( 2),DTPUMP( 2),DTMORE( 2),STORF( 2),APLAN( 2),  TSTR  25
     *  CLAND( 2),CSTOR( 2),CPS( 2),CTOTAL( 2),CPCUYD( 2),CPACRE( 2),   TSTR  26
     *  LP,JP,LPREV( 2),LABEL,DETENT(150),FRAC(150),OUT1(10,200)        TSTR  27
C                                                                       TSTR  28
C****    NEXT CARD CHANGED BY TS OF EH%A ON  1/25/76        *************
      DIMENSION  ADEPTH(11),AASURF(11)                                  TSTR  29
      DIMENSION QQ1(150),QQ2(150)                                       TSTR  30
      EQUIVALENCE (QQ1(1),QMAX(1)),(QQ2(1),QFULL(1))                    TSTR  31
10000 IF ( NSTOR .EQ. 0)  STOP 10000                                    TSTR  32
C                                                                       TSTR  33
11111 DO 8888  KSTOR=1, NSTOR                                           TSTR  34
      WRITE(6,601)  KSTOR                                               TSTR  35
  601 FORMAT('1',//, '0INPUT DATA FOR STORAGE  UNIT NO.', I3, ' FOLLOWS'TSTR  36
     *)                                                                 TSTR  37
      READ(5,501)  ISTMOD(KSTOR), ISTTYP(KSTOR), ISTOUT(KSTOR)          TSTR  38
  501 FORMAT(10I5)                                                      TSTR  39
      IF(ISTMOD(KSTOR).LE.0) ISTMOD(KSTOR) = 1                          TSTR  40
      IF(ISTTYP(KSTOR).LE.0) ISTTYP(KSTOR) = 1                          TSTR  41
      IF(ISTOUT(KSTOR).LE.0) ISTOUT(KSTOR) = 1                          TSTR  42
C                                                                       TSTR  43
C                    NOTE.,   OPERATIONAL OPTIONS INDICATED BY '*'      TSTR  44
C                                                                       TSTR  45
C                    KSTOR  = STORAGE  UNIT NO.                         TSTR  46
C                    NUED   = NO. OF UPSTREAM ELEMENT                   TSTR  47
C                                                                       TSTR  48
C                    ISTMOD = STORAGE  MODE (ROUTING, HOLDING, ETC)     TSTR  49
C                *          = 1 = IN-LINE                               TSTR  50
C                           = 2 = OFF-LINE                              TSTR  51
C                           = 3 = INTRASYSTEM                           TSTR  52
C                           = 4 = REROUTING                             TSTR  53
C                    ISTTYP = STORAGE  STRUCTURE (NATURAL, TANK, BAG)   TSTR  54
C                *          = 1 = IRREGULAR (NATURAL) RESERVOIR         TSTR  55
C                *          = 2 = GEOMETRIC (REGULAR) RESERVOIR - COVEREDTSTR  56
C                *          = 3 = GEOMETRIC (REGULAR) RESERVOIR - UNCOVERTSTR  57
C                           = 4 = INTRASYSTEM                           TSTR  58
C                           = 5 = RUBBER BAG                            TSTR  59
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C-EXCLUDED          ISTEXS = EXCESS FLOW HANDLING (BYPASS, BACK-UP, FLOOTSTR 60
C-EXCLUDED                 = 1 = BYPASS FRACTION CONTINUOUSLY, UNDER GRATSTR 61
C-EXCLUDED                 = 2 = BYPASS FRACTION CONTINUOUSLY, CONTROLLETSTR 62
C-EXCLUDED                 = 3 = BYPASS ALL, AFTER SURCHARGE BEGINS (CONTSTR 63
C-EXCLUDED                 = 4 = BACK UP                                 TSTR 64
C-EXCLUDED                 = 5 = PASS THROUGH (UNDER HEAD)               TSTR 65
C-EXCLUDED      *          = 6 = FLOODS (AND SIMULATION TERMINATES)      TSTR 66
C                   ISTOUT = OUTLET TYPE (GRAVITY, PUMP)                 TSTR 67
C               *          = 1 = GRAVITY WITH FIXED ORIFICE              TSTR 68
C               *          = 2 = GRAVITY WITH FIXED WEIR                 TSTR 69
C                          = 3 = GRAVITY WITH FIXED SIDE-WEIR            TSTR 70
C                          = 4 = GRAVITY WITH FIXED SIPHON               TSTR 71
C               *          = 5 = DOUBLE PUMPING                          TSTR 72
C               *          = 6 = EXISTING PUMPS                          TSTR 73
C                          = 7 = ADJUSTABLE VALVE WITH GRAVITY           TSTR 74
C                          = 8 = SLUICE GATE WITH GRAVITY                TSTR 75
C               *          = 9 = GRAVITY WITH FIXED WEIR AND ORIFICE     TSTR 76
C-EXCLUDED          ISTBUP = BACK-UP EFFECTS (YES/NO)                    TSTR 77
C-EXCLUDED                 = 1 = NO                                      TSTR 78
C-EXCLUDED                 = 2 = YES, UPSTREAM OF INLET POINT            TSTR 79
C-EXCLUDED                 = 3 = YES, UPSTREAM OF OUTLET POINT           TSTR 80
C                                                                        TSTR 81
      DO 950  KK=1,NE                                                    TSTR 82
      IF(KSTORE(KK).EQ,KSTOR) GO TO 970                                  TSTR 83
 950  CONTINUE                                                           TSTR 84
      WRITE(6,604)                                                       TSTR 85
  604 FORMAT('0ELEMENT NO, TRACEBACK ERROR')                             TSTR 86
      STOP                                                               TSTR 87
  970 WRITE(6,602)  KSTOR, NOE(KK),(NUE(KK,II),II=1,3),                  TSTR 88
     *              ISTOUT(KSTOR), ISTMOD(KSTOR), ISTTYP(KSTOR)          TSTR 89
  602 FORMAT('0', /, ' ', 5X,                                            TSTR 90
     *              'CHARACTERISTICS OF STORAGE  UNIT NUMBER', I4, ' ARE'TSTR 91
     *       /,  '0', 10X, 'ELEMENT NUMBER =', I4, 24X,                  TSTR 92
     *                     'U/S ARE', I4, ',', I4, ',', I4, 23X,         TSTR 93
     *                     'OUTLET TYPE  =',  I3, 12X,                   TSTR 94
     *       /,  ' ', 10X, 'STORAGE  MODE   =', I3, 27X,                 TSTR 95
     *                     'STORAGE  TYPE =',  I3)                       TSTR 96
C                   IPOL   = 0 = HYDRAULICS ONLY (NO SOLIDS)             TSTR 97
C                          = 1 = SOLIDS PRESENT                          TSTR 98
C                          = 2 = PERFECT MIXING IN BASIN                 TSTR 99
C                   IPRINT = 0 = NO PRINTOUT EACH TIME-STEP (SUMMARY POSTSTR100
C                          = 1 = PRINTOUT ALL TIME-STEP SOLUTIONS (EACH TSTR101
      READ(5,502)  IPOL(KSTOR), IPRINT(KSTOR), ICOST(KSTOR)              TSTR102
  502 FORMAT(3I10)                                                       TSTR103
      IF(NPOLL.LT,1) IPOL(KSTOR) = 0                                     TSTR104
      WRITE(6,603)  IPOL(KSTOR), IPRINT(KSTOR), ICOST(KSTOR)             TSTR105
  603 FORMAT('0', 99X, 'IPOL =', I2, ', IPRINT =', I2, ', ICOST =', I2) TSTR106
C                                                                        TSTR107
C---------          READ RESERVOIR PARAMETERS                            TSTR108
C                                                                        TSTR109
C                                                                        TSTR110
C                   BRANCH TO STORAGE  TYPE (ISTTYP)                     TSTR111
C                                                                        TSTR112
 1000   K = ISTTYP(KSTOR)                                                TSTR113
      GO TO (1100,1200,1200, 904, 904), K                                TSTR114
C                                                                        TSTR115
C***  GO TO (1100,1200,1200, 904, 904), K                                TSTR116
C                                                                        TSTR117
C                   A)  FOR IRREGULAR (NATURAL) RESERVOIR                TSTR118
C                                                                        TSTR119
 1100 READ(5,511)  DEPMAX(KSTOR)                                         TSTR120
  511 FORMAT(F10,2)                                                      TSTR121
C                   DEPMAX = MAX, ALLOWABLE DEPTH IN RESERVOIR (FT,)     TSTR122
      WRITE(6,611)  DEPMAX(KSTOR)                                        TSTR123
  611 FORMAT('0', 15X, 'NATURAL RESERVOIR, WITH MAX, DEPTH =', F7,2,     TSTR124
     *' FT.',10X,  ' 11 DEPTH/AREA PARAMETERS ARE', //,..                TSTR125
     *       ' ', 20X, 4('DEPTH(FT) AREA(SQ,FT)', 4X))
      READ(5,512)  (ADEPTH(II), AASURF(II),  II=1,11)
  512 FORMAT(4(F10.2, F10,0))
C                     ADEPTH = DATA DEPTH (FT), 0 - DEPMAX,
C                     AASURF = DATA SURF, AREA OF NAT, RESERVOIR (SQ, FT,)
      WRITE(6,612)  (ADEPTH(II), AASURF(II),  II=1,11)
  612 FORMAT(   ' ', 16X, F10.2, F10,0, 5X, F10,2, F10,0, 5X,
     *                      F10,2, F10,0, 5X, F10,2, F10,0)
        APLAN(KSTOR) = AASURF(11)
      IF (ADEPTH(11) .LT. DEPMAX(KSTOR))  GO TO 903
      GO TO 2000
C
C                     B)  FOR REGULAR (MAN-MADE) RESERVOIR
C
 1200 READ(5,511)  DEPMAX(KSTOR)
      READ(5,513)  BASEA, BASEC, COTSLO
  513 FORMAT(2F10,0, F10,5)
C                     BASEA  = BASE AREA OF RESERVOIR (SQ,FT,)
C                     BASEC  = BASE CIRCUMF, OF RESERVOIR (FT,)
C                     COTSLO = COTAN OF SIDESLOPE ANGLE (HORIZ/VERT)
        APLAN(KSTOR) = BASEA + BASEC*COTSLO*DEPMAX(KSTOR)*1,1
      WRITE(6,613)  DEPMAX(KSTOR), BASEA, BASEC, COTSLO
  613 FORMAT('0', 15X, 'MAN-MADE RESERVOIR, WITH MAX, DEPTH =', F7,2,
     *   ' FT,,  AND CHARACTERISTICS',   /, '0', 20X,
     *       'BASE AREA =', F10,0, ' SQ,FT,,', 7X,
     *       'BASE CIRCUMF, =', F10,0, ' FT,,', 6X,
     *       'COT(SIDESLOPE) =', F10,5)
C
C----------           READ OUTLET CONTROL DATA
C
C                     BRANCH TO OUTLET TYPE (ISTOUT)
C
 2000   K = ISTOUT(KSTOR)
      GO TO (2100,2200, 906, 906,2600,2600, 906, 906,2900), K
C
C                     A)  OUTLET BY GRAVITY WITH FIXED ORIFICE
C
 2100 READ(5,521)  CDAOUT
  521 FORMAT(F10,3)
C                     CDAOUT = OUTLET ORIFICE AREA * DISCHARGE COEFFICIENT
      WRITE(6,621)  CDAOUT, DT
  621 FORMAT('0', 15X, 'RESERVOIR OUTLET CONTROL BY GRAVITY WITH FIXED O
     *RIFICE', /, ' ', 15X, 'ORIFICE AREA*CD =', F10,3, ' SQ.FT,  DT =',
     *F10,2, ' SEC, (FROM INPUT HYDROGRAPH)', /, ' ', 15X, 'NOTE,,', /,
     *' ', 16X, 'ORIFICE CENTERLINE ASSUMED AT TANK DEPTH = 0, WHEN STOR
     *AGE = 0')
C
      GO TO 3000
C
C                     B)  OUTLET BY GRAVITY WITH FIXED WEIR
C
 2200 READ(5,522)  WEIRHT, WEIRL
  522 FORMAT(2F10,3)
C                     WEIRHT = RES, DEPTH (FT) WHEN SURF, AT WEIR ELEV,
C                     WEIRL  = WEIR LENGTH (FT)
C                     WEIRQ  = 3,33*(DEPTH-WEIRHT)**1,5  (CFS/FT)
      WRITE(6,622)  WEIRHT, WEIRL, DT
  622 FORMAT('0', 15X, 'RESERVOIR OUTLET CONTROL BY GRAVITY WITH FIXED W
     *EIR', /, ' ', 15X, 'WEIR HEIGHT =', F6,2, ' FT, WEIR LENGTH =',
     * F7,2, ' FT,  DT =', F10,2, ' SEC, (FROM INPUT HYDROGRAPH)')
C
      GO TO 3000
C
C                     F) OUTLET BY EXISTING PUMPS
C
 2600 READ(5,526)  QPUMP(KSTOR),DSTART(KSTOR),DSTOP(KSTOR)
```

```
  526 FORMAT(3F10,3)
C                    QPUMP  = CONSTANT PUMPED OUTFLOW RATE (CFS)
C                    DSTART = RESERVOIR DEPTH AT START OF PUMPING (FT)
C                    DSTOP  = RESERVOIR DEPTH AT END   OF PUMPING (FT)
      WRITE(6,626)  QPUMP(KSTOR),DSTART(KSTOR),DSTOP(KSTOR)
  626 FORMAT('0', 15X, 'RESERVOIR OUTFLOW BY FIXED-RATE PUMPING', /,
     *       ' ', 15X, 'PUMPING RATE =', F7,2, ' CFS, PUMPING START',
     *       ' DEPTH =', F6,2, ' FT, PUMPING STOP DEPTH =', F6,2, ' FT')
      IF (DSTART(KSTOR) ,GT, DSTOP(KSTOR))  GO TO 3000
C
        DSTOP(KSTOR) = DSTART(KSTOR) - 0,5
      WRITE(6,627)
  627 FORMAT('0****** WARNING, STOP DEPTH SHOULD BE LESS THAN START',
     *       ' DEPTH', /, ' ', 10X, 'RESET STOP DEPTH TO', F6,2, ' FT')
      GO TO 3000
C
C                    I)   OUTLET BY GRAVITY WITH FIXED WEIR AND ORIFICE
C
 2900 READ (5,529) WEIRHT,WEIRL,CDAOUT,ORIFHT
  529 FORMAT (8F10.5)
C                    WEIRHT = RES,DEPTH (FT) WHEN SURF, AT WEIR ELEV,
C                    WEIRL  = WEIR LENGTH (FT)
C                    CDAOUT = OUTLET ORIFICE AREA * DISCHARGE COEFFICIENT
C                    ORIFHT = ORIF, CENTERLINE ELEV, ABOVE ZERO DEPTH(FT)
      WRITE (6,629) WEIRHT,WEIRL,DT,CDAOUT,ORIFHT
  629 FORMAT (/16X,'RESERVOIR OUTLET CONTROL BY GRAVITY WITH FIXED ORIFI
     1CE AND FIXED WEIR'/16X,'WEIR HEIGHT=',F6,2,' FT, WEIR LENGTH='
     2 F7,2,' FT, DT=',F10,2,' SEC, (FROM INPUT HYDROGRAPH)'/16X,
     3'ORIFICE AREA*CD='F10,3,' SQ,FT, HEIGHT OF ORIFICE CENTERLINE ABOV
     4E ZERO DEPTH='F6,2,' FT')
      J = GEOM3(KK)
      WRITE (6,630) J
  630 FORMAT (16X,'OUTFLOW FROM ORIFICE IS TO ELEMENT NUMBER'I5)
      GO TO 3000
C
C                    END OF INPUT PARAMETERS FOR STORAGE UNITS
C
C
C------------------ COMPUTE DEPTH/STORAGE RELATION (ARRAY) -------------
C
C                    NOTE
C                     RUBBER BAG AND INTRASYSTEM DO NOT HAVE 'DEPTH'
C
C                    BRANCH TO STORAGE TYPE (ISTTYP)
C
 3000   K = ISTTYP(KSTOR)
      GO TO (3100,3200,3200, 904, 904), K
C
C---------           A)  FOR 'NATURAL' RESERVOIR
C
 3100   DDEPTH = DEPMAX(KSTOR)/10,0
      J = ISTOUT(KSTOR)
      IF (J,EQ,2,OR,J,EQ,3,OR,J,EQ,9) DDEPTH = WEIRHT/3,0
        DUMDEP(1) = 0,0
        DEPTH  = 0,0
C
      CALL TINTRP(ADEPTH, AASURF, 11, DEPTH, AREA, KFLAG)
C
      IF (KFLAG ,NE, 0)  GO TO 901
        AREA2  = AREA
        DUMSTR(1) = 0,0
      DO 3150  II=2,11
        AREA1  = AREA2
      IF ((J,EQ,2,OR,J,EQ,3,OR,J,EQ,9),AND,II,EQ,5) DDEPTH =
     * (DEPMAX(KSTOR) - WEIRHT)/7,0
        DUMDEP(II) = DUMDEP(II-1) + DDEPTH
        DUMMY  = DUMDEP(II)                                             TSTR258
C                                                                       TSTR259
      CALL TINTRP(ADEPTH, AASURF, 11, DUMMY, AREA, KFLAG)               TSTR260
C                                                                       TSTR261
      IF (KFLAG ,NE, 0)  GO TO 901                                      TSTR262
        AREA2  = AREA                                                   TSTR263
 3150   DUMSTR(II) = DUMSTR(II-1) + 0,5*DDEPTH*(AREA1+AREA2)            TSTR264
      WRITE(6,631)                                                      TSTR265
  631 FORMAT('0', 20X, 4('DEPTH(FT) STOR(CU,FT)', 4X))                  TSTR266
      WRITE(6,632)  (DUMDEP(II), DUMSTR(II),  II=1,11)                  TSTR267
  632 FORMAT(    ' ', 18X, F9,2, F11,0, 5X, F9,2, F11,0, 5X,            TSTR268
     *                     F9,2, F11,0, 5X, F9,2, F11,0)                TSTR269
      GO TO 3300                                                        TSTR270
C                                                                       TSTR271
C---------            B)  FOR MAN-MADE RESERVOIR                        TSTR272
C                                                                       TSTR273
 3200   DDEPTH = DEPMAX(KSTOR)/10,0                                     TSTR274
C   ^^^^^^^^^   DEPTH = 0,0   ^^^^^^^^^^^^                              TSTR275
      DEPTH = 0,0                                                       TSTR276
      J = ISTOUT(KSTOR)                                                 TSTR277
      IF (J,EQ,2,OR,J,EQ,3,OR,J,EQ,9) DDEPTH = WEIRHT/3,0               TSTR278
        DUMDEP(1) = 0,0                                                 TSTR279
        DUMSTR(1) = 0,0                                                 TSTR280
      DO 3250  II=2,11                                                  TSTR281
      IF ((J,EQ,2,OR,J,EQ,3,OR,J,EQ,9),AND,II,EQ,5) DDEPTH =            TSTR282
     * (DEPMAX(KSTOR) - WEIRHT)/7,0                                     TSTR283
        DUMDEP(II) = DUMDEP(II-1) + DDEPTH                              TSTR284
 3250   DUMSTR(II) = (BASEA + 0,5*BASEC*DUMDEP(II)*COTSLO)*DUMDEP(II)   TSTR285
      WRITE(6,631)                                                      TSTR286
      WRITE(6,632)  (DUMDEP(II), DUMSTR(II),  II=1,11)                  TSTR287
C                                                                       TSTR288
 3300 DO 3350  II=1,11                                                  TSTR289
        BSTOR(KSTOR,II)  = DUMSTR(II)                                   TSTR290
 3350   BDEPTH(KSTOR,II) = DUMDEP(II)                                   TSTR291
C                                                                       TSTR292
C                     END OF DEPTH/STORAGE COMPUTATIONS                 TSTR293
C                                                                       TSTR294
C------------------ BRANCH TO STORAGE MODE (ISTMOD) --------------------TSTR295
C                                                                       TSTR296
        K = ISTMOD(KSTOR)                                               TSTR297
      GO TO (4000, 905, 905, 905), K                                    TSTR298
C                                                                       TSTR299
C------------------ COMPUTE AND PRINT ROUTING PARAMETERS -------------- TSTR300
C                                                                       TSTR301
C                     BRANCH TO OUTLET TYPE (ISTOUT)                    TSTR302
C                                                                       TSTR303
 4000   K = ISTOUT(KSTOR)                                               TSTR304
      GO TO (4100,4200, 906, 906, 8000,4600, 906, 906,4900), K          TSTR305
C                                                                       TSTR306
C--------------       COMPUTE AND PRINT ROUTING PARAMETERS    --------- TSTR307
C                                                                       TSTR308
C---------            A)  FOR ORIFICE OUTLET                            TSTR309
C                                                                       TSTR310
 4100   DT2    = 0,5*DT                                                 TSTR311
      DO 4150  II=1,11                                                  TSTR312
        DUMMY  = DUMDEP(II)                                             TSTR313
        STOR   = DUMSTR(II)                                             TSTR314
        QOUT   = CDAOUT*SQRT(64,4*DUMMY)                                TSTR315
C                                                                       TSTR316
        AO2DT2(KSTOR,II) = QOUT*DT2                                     TSTR317
 4150   ATERM(KSTOR,II)  = QOUT*DT2 + STOR                              TSTR318
      WRITE(6,641)  DT, (ATERM(KSTOR,II), II=1,11),                     TSTR319
     *                  (AO2DT2(KSTOR,II), II=1,11)                     TSTR320
  641 FORMAT('0', 20X, 'THE TWO SETS OF 11 STORAGE PARAMETERS, FOR DT ='TSTR321
     *       , F10,3, ' SEC,, ARE,,',  /, '0', 11X, 'ATERM,, ',         TSTR322
     *                 11F10.0,  /, ' ', 11X, 'AO2DT2..', 11F10.0)      TSTR323
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```
      GO TO 8000
C
C---------          B)  FOR WEIR OUTLET
C
 4200   DT2    = 0.5*DT
      DO 4250  II=1,11
        DUMMY  = DUMDEP(II)
        STOR   = DUMSTR(II)
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```
        H      = DUMMY - WEIRHT
        QOUT   = 0.0
      IF (H ,GT, 0,0)  QOUT = WEIRL*3,33*H*SQRT(H)
C
        AO2DT2(KSTOR,II) = QOUT*DT2
 4250   ATERM(KSTOR,II)  = QOUT*DT2 + STOR
      WRITE(6,641)  DT, (ATERM(KSTOR,II), II=1,11),
     *                  (AO2DT2(KSTOR,II), II=1,11)
      GO TO 8000
C
C--------------      CHECK BUFFER VOLUME FOR PUMPED OUTFLOW     ---------
C
 4600   DSTRT = DSTART(KSTOR)
      CALL TINTRP(DUMDEP, DUMSTR, 11, DSTRT, STORHI, KFLAG)
C
```

```
      IF (KFLAG ,NE, 0)  GO TO 901
C
        DSTP = DSTOP(KSTOR)
      CALL TINTRP(DUMDEP, DUMSTR, 11, DSTP, STORLO, KFLAG)
C
      IF (KFLAG ,NE, 0)  GO TO 901
        STORDV = STORHI - STORLO
        PUMPDV = QPUMP(KSTOR)*DT
        DVR    = STORDV/PUMPDV
      IF (DVR ,LT, 1,0)  GO TO 4650
C
      WRITE(6,646)  DVR
  646 FORMAT('0', 15X, 'STORAGE BETWEEN LEVELS DSTART AND DSTOP =',
     *        F7,3, ' TIMES (QPUMP*DT)')
      GO TO 8000
C
 4650 WRITE(6,647)  STORHI, STORLO, STORDV, PUMPDV
  647 FORMAT('0',20X, 'AT LEVEL DSTART, STORAGE    =', F10,0,' CU,FT',/,
     *        ' ',20X, 'AT LEVEL DSTOP,  STORAGE    =', F10,0,' CU,FT',/,
     *        ' ',20X, 'DIFFERENCE = BUFFER STORAGE =', F10,0,' CU,FT',/,
     *   '0',16X, 'CF, VOLUME PUMPED / TIME-STEP   =', F10,0,' CU,FT',/,
     *   '0',10X, 'A RELIABLE MODEL REQUIRES THE VOLUME PUMPED / TIME-',
     *   'STEP TO BE LESS THAN THE BUFFER STORAGE', /,
     *   ' ',10X, 'THEREFORE ONE OF THE FOLLOWING AMENDMENTS SHOULD ',
     *   'PROBABLY BE MADE TO THE INPUT DATA -', /,
     *   ' ',15X, 'A)  REDUCE QPUMP RATE', /,                           TSTR372
     *   ' ',15X, 'B)  REDUCE DSTOP LEVEL', /,                          TSTR373
     *   ' ',15X, 'C)  INCREASE DSTART LEVEL', /,                       TSTR374
     *   ' ',15X, 'D)  INCREASE RESERVOIR PLAN AREAS', /,               TSTR375
     *   '0', 2X, '****    FOR THE ABOVE REASONS, THE FOLLOWING OUTPUT',TSTR376
     *   ' IS NOT NECESSARILY RELIABLE')                                TSTR377
      GO TO 8000                                                        TSTR378
C                                                                       TSTR379
C---------           1)  FOR WEIR AND ORIFICE OUTLETS COMBINED          TSTR380
C                                                                       TSTR381
 4900 DT2 = 0,5*DT                                                      TSTR382
      DO 4950 II=1,11                                                   TSTR383
      DUMMY = DUMDEP(II)                                                TSTR384
      STOR = DUMSTR(II)                                                 TSTR385
      QOUT = 0,0                                                        TSTR386
      DD = DUMMY-ORIFHT                                                 TSTR387
      IF (DD,GT,0,0) QOUT=QOUT+CDAOUT*SQRT(64,4*DD)                     TSTR388
      OUT1(KSTOR,II) = QOUT*DT2                                         TSTR389
      H = DUMMY-WEIRHT                                                  TSTR390
      IF (H,GT,0,0) QOUT=QOUT+WEIRL*3,33*H*SQRT(H)                      TSTR391
      AO2DT2(KSTOR,II) = QOUT*DT2                                       TSTR392
 4950 ATERM(KSTOR,II) = QOUT*DT2+STOR                                   TSTR393
      WRITE (6,641) DT,(ATERM(KSTOR,II),II=1,11),                       TSTR394
     1 (AO2DT2(KSTOR,II),II=1,11)                                       TSTR395
      GO TO 8000                                                        TSTR396
C                                                                       TSTR397
C------------------ READ RESERVOIR INITIAL CONDITIONS ------------------TSTR398
C                                                                       TSTR399
C                    STORO  = STORAGE (CU,FT,) AT T = 0                 TSTR400
C                    QOUTO  = OUTFLOW RATE (CFS) AT T = 0               TSTR401
 8000 READ(5,551)  STORO(KSTOR), QOUTO(KSTOR)                           TSTR402
  551 FORMAT(2F10,2)                                                    TSTR403
      STORL(KSTOR)=STORO(KSTOR)                                         TSTR404
C                                                                       TSTR405
C------------------ READ STORAGE UNIT UNIT COSTS -----------------------TSTR406
C                                                                       TSTR407
      READ(5,561)  CPCUYD(KSTOR), CPACRE(KSTOR), CPS(KSTOR)             TSTR408
  561 FORMAT(F10,2, 2F10,0)                                             TSTR409
C                                                                       TSTR410
        IFLOOD(KSTOR) = 0                                               TSTR411
C                                                                       TSTR412
 8888 CONTINUE                                                          TSTR413
C                                                                       TSTR414
      GO TO 9999                                                        TSTR415
C                                                                       TSTR416
C------------------ ERROR MESSAGES -------------------------------------TSTR417
C                                                                       TSTR418
  901 IF (KFLAG ,EQ, 10)  GO TO 902                                     TSTR419
      WRITE(6,691)                                                      TSTR420
  691 FORMAT('0 *** TERMINATE - INPUT TO TINTRP PROCEDURE IS LESS THAN LTSTR421
     *OWEST VALUE ON CURVE (IN SUBRT, TSTRDT)')                         TSTR422
      STOP                                                              TSTR423
C                                                                       TSTR424
  902 WRITE(6,692)                                                      TSTR425
  692 FORMAT('0 *** TERMINATE - INPUT TO TINTRP PROCEDURE IS GREATER THATSTR426
     *N LARGEST VALUE ON CURVE (IN SUBRT, TSTRDT)')                      TSTR427
      STOP                                                              TSTR428
C                                                                       TSTR429
  903 WRITE(6,693)  KSTOR, DEPMAX(KSTOR), ADEPTH(11)                    TSTR430
C****   FORMAT ORIGINALLY TOO LONG CHANGED BY TWS OF EHA  2/11/75
C 693 FORMAT('0 *** FOR RESERVOIR NO,', I4,                             TSTR431
  693 FORMAT('0 *** FOR RESERVOIR NO,', I4,/,1H ,                       TSTR431
     *                                   ', THE MAX, DEPTH, DEPMAX =',  TSTR432
     * F7,2, ' FT, IS OUTSIDE DEPTH PARAMETER RANGE,  LARGEST DEPTH PARATSTR433
     *METER, ADEPTH(11) =', F7,2)                                       TSTR434
      STOP                                                              TSTR435
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C                                                                       TSTR436
  904 WRITE(6,694)  ISTTYP(KSTOR), KSTOR                                 TSTR437
  694 FORMAT('0 *** ISTTYP =', I3, ', IN RESERVOIR NO,', I4,            TSTR438
     * ', IS OF A TYPE NOT PRESENTLY MODELED')                          TSTR439
      STOP                                                              TSTR440
C                                                                       TSTR441
  905 WRITE(6,695)  ISTMOD(KSTOR), KSTOR                                TSTR442
  695 FORMAT('0 *** ISTMOD =', I3, ', IN RESERVOIR NO.', I4,            TSTR443
     *        ',. IS OF A TYPE NOT PRESENTLY MODELED')                  TSTR444
      STOP                                                              TSTR445
C                                                                       TSTR446
  906 WRITE(6,696)  ISTOUT(KSTOR), KSTOR                                TSTR447
  696 FORMAT('0 *** ISTOUT =', I3, ', IN RESERVOIR NO,', I4,            TSTR448
     *        ', IS OF A TYPE NOT PRESENTLY MODELED')                   TSTR449
      STOP                                                              TSTR450
C                                                                       TSTR451
C 907 WRITE(6,697)  ISTINF, KSTOR                                       TSTR452
C 697 FORMAT('0 *** ISTINF =', I3, ', IN RESERVOIR NO,', I4,            TSTR453
C    *        ', IS OF A TYPE NOT PRESENTLY MODELED')                   TSTR454
C     STOP                                                              TSTR455
C                                                                       TSTR456
C                                                                       TSTR457
 9999 RETURN                                                            TSTR458
      END                                                               TSTR459
*DECK,DEPTH
      FUNCTION DEPTH(ALPHA)                                             DEPT   1
C=======================================================================DEPT   2
C     COMPUTES NORMALIZED DEPTH IN CONDUIT GIVEN NORMALIZED AREA, ALPHA.DEPT   3
      DIMENSION QI(160),QO(160)                                         DEPT   4
      COMMON/TABLES/ KDEPTH(35),KLASS(35),PSIMAX(25),ALFMAX(25),NN(35),
     1               MM(35),ANORM(25,51),QNORM(25,51),DNORM(25,51),
     2   AFACT(25),  RFACT(25)
      COMMON A(160,2,2),Q(160,2,2),CPOL1(160,2,5),CPOL2(160,2,5),QMAX(16DEPT   8
     10),     QFULL(160), AFULL(160), DXDT(160),C1(160), SLOPE(160),    DEPT   9
     2        DIST(160), GEOM1(160), ROUGH(160), NOE(160), NUE(160,3),  DEPT  10
     3        INUE(160,3), NTYPE(160), JR(160), NKLASS, NE, NDT, EPSIL, DEPT  11
     4        TIME, DT, M, KFULL, N, NOS, NPOLL, NPRINT, ITER,          DEPT  12
     5        QDWF(160), IOLD(160), P1(160), RNOFF(160), QINFIL(160),   DEPT  13
     6        WDWF(160,5), PLUTO(160,5), IR(160), P2(160), NIN(1000),   DEPT  14
     7        P5(160),P6(160),P7(160),SCF(160),BARREL(160),             DEPT  15
     8        TITLE(40), NPE(20), NYN(20), NORDER(70), GEOM2(160),      DEPT  16
     9        GEOM3(160) , P4(160),SCOUR(160), KSTORE(160)              DEPT  17
      COMMON  BODIN( 2,150),SSIN( 2,150),BODOUT,SSOUT,COLIN(2,150),     DEPT  18
     *  QINST,QOUST,QINSTL( 2),QOUSTL( 2),STORL( 2),QOUTO( 2),STORO( 2),DEPT  19
     *  NSTOR,KSTOR,IPRINT( 2),IPOL( 2),IFLOOD( 2),ICOST( 2),DEPMAX( 2),DEPT  20
     *  ATERM( 2,11),AO2DT2( 2,11),BDEPTH( 2,11),BSTOR( 2,11),COLOUT,   DEPT  21
     *  DUMSTR(11),DUMDEP(11),                                          DEPT  22
     *  KTSTEP,VOLIN( 2,150),VOLOUT( 2,150),STOR,CUMIN( 2),CUMOUT( 2),  DEPT  23
     *  SBOD( 2),SSS( 2),SCOL( 2),                                      DEPT  24
     *  ISTMOD( 2),ISTTYP( 2),ISTOUT( 2),                               DEPT  25
     *  QPUMP( 2),DSTART( 2),DSTOP( 2),                                 DEPT  26
     *  DTON( 2),STORMX( 2),DTPUMP( 2),DTMORE( 2),STORF( 2),APLAN( 2),  DEPT  27
     *  CLAND( 2),CSTOR( 2),CPS( 2),CTOTAL( 2),CPCUYD( 2),CPACRE( 2),   DEPT  28
     *  LP,JP,LPREV( 2),LABEL,DETENT(150),FRAC(150),OUT1(10,200)        DEPT  29
      EQUIVALENCE (QO(1),Q(1,2,2)),(QI(1),Q(1,1,2))                     DEPT  30
      IF(ALPHA.EQ.0.0) GO TO 80                                         DEPT  31
      NT = NTYPE(M)                                                     DEPT  32
C     KDEPTH(NT) = 1 FOR CONDUIT WITH A FUNCTIONAL D-A RELATIONSHIP,    DEPT  33
C     KDEPTH(NT) = 2 FOR CONDUIT WITH A TABULAR D-A RELATIONSHIP,       DEPT  34
C     KDEPTH(NT) = 3 FOR ELEMENT OTHER THAN CONDUIT,                    DEPT  35
      IF (KDEPTH(NT).EQ.2) GO TO 50                                     DEPT  36
      IF (NT.EQ.2) GO TO 80                                             DEPT  37
      IF (NT.EQ.10) GO TO 100                                           DEPT  38
      IF (NT.EQ.11) GO TO 110                                           DEPT  39
      IF (NT.EQ.12) GO TO 120                                           DEPT  40
      IF(NT.EQ.13) GO TO 130                                            DEPT  41
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C      ROUTINE FOR TABULAR D-A CURVE,                                   DEPT 42
C      LINEAR  INTRPOLATION BETWEEN TABULAR POINTS IS USED,             DEPT 43
   50 DALPHA = 1,0/(FLOAT(NN(NT)) - 1,0)                                DEPT 44
      I = ALPHA/DALPHA+1,0                                              DEPT 45
      DEPTH = DNORM(NT,I)+(ALPHA-ANORM(NT,I))/DALPHA*(DNORM(NT,I+1)-    DEPT 46
     1 DNORM(NT,I))                                                     DEPT 47
      RETURN                                                            DEPT 48
C      IN RECTANGULAR CONDUIT, NORMALIZED DEPTH EQUALS NORMALIZED AREA, DEPT 49
   80 DEPTH = ALPHA                                                     DEPT 50
      RETURN                                                            DEPT 51
C      FUNCTIONAL FORM FOR MODIFIED BASKET-HANDLE,                      DEPT 52
  100 AA = ALPHA*AFULL(M)                                               DEPT 53
      IF (AA,GT,GEOM3(M)) GO TO 105                                     DEPT 54
      DEPTH = AA/GEOM2(M)/(GEOM1(M)+GEOM2(M)/2,0)                       DEPT 55
      RETURN                                                            DEPT 56
  105 ALF = (AA-GEOM3(M)+P5(M)/2,0)/P5(M)                               DEPT 57
      I = ALF/0,02+1,0                                                  DEPT 58
      DD = DNORM(1,I)+(ALF-ANORM(1,I))/0,02*(DNORM(1,I+1)-DNORM(1,I))   DEPT 59
      DEPTH = ((DD-0,5)*GEOM2(M)+GEOM1(M))/(GEOM1(M)+GEOM2(M)/2,0)      DEPT 60
      RETURN                                                            DEPT 61
C      FUNCTIONAL FORM FOR RECTANGULAR, TRIANGULAR BOTTOM,              DEPT 62
  110 AA = ALPHA*AFULL(M)                                               DEPT 63
      AB = GEOM3(M)*GEOM2(M)/2,0                                        DEPT 64
      IF (AA-AB) 111,113,115                                            DEPT 65
  111 DEPTH = GEOM3(M)/GEOM1(M)*SQRT(AA/AB)                             DEPT 66
      RETURN                                                            DEPT 67
  113 DEPTH = GEOM3(M)/GEOM1(M)                                         DEPT 68
      RETURN                                                            DEPT 69
  115 DEPTH = (GEOM3(M)+(AA-AB)/GEOM2(M))/GEOM1(M)                      DEPT 70
      RETURN                                                            DEPT 71
C      FUNCTIONAL FORM FOR RECTANGULAR, ROUND BOTTOM,                   DEPT 72
  120 AA = ALPHA*AFULL(M)                                               DEPT 73
      IF (AA,GT,P6(M)) GO TO 125                                        DEPT 74
      ALF = ALPHA*AFULL(M)/(3,1415965*GEOM3(M)*GEOM3(M))                DEPT 75
      I = ALF/0,02+1,0                                                  DEPT 76
      DEPTH = DNORM(1,I)+(DNORM(1,I+1)-DNORM(1,I))/0,02*(ALF-ANORM(1,I))DEPT 77
      DEPTH = DEPTH*2,0*GEOM3(M)/(P2(M)*DIST(M))                        DEPT 78
      RETURN                                                            DEPT 79
  125 DD = P2(M)*DIST(M)-GEOM1(M)                                       DEPT 80
      DEPTH = (DD+(AA-P6(M))/GEOM2(M))/(P2(M)*DIST(M))                  DEPT 81
      RETURN                                                            DEPT 82
C     FUNCTIONAL FORM FOR TRAPEZOID                                     DEPT 83
  130 AA = ALPHA * AFULL(M)                                             DEPT 84
      DEPTH = (-GEOM2(M) + SQRT(GEOM2(M)**2 + 4.0 * AA/GEOM3(M))) *     DEPT 85
     1GEOM3(M)/2,0/GEOM1(M)                                             DEPT 86
      RETURN                                                            DEPT 87
      END                                                               DEPT 88
*DECK,DPSI
      FUNCTION DPSI(ALPHA)                                              DPSI  1
C=======================================================================DPSI  2
C      FINDS DERIVATIVE OF FUNCTIONAL Q-A CURVE GIVEN A/AFULL (ALPHA),  DPSI  3
C*****NOTE, FOR NT=2,10,11,12, SUB PSI MUST HAVE BEEN CALLED PRIOR TO   DPSI  4
C      DPSI,                                                            DPSI  5
C      THIS WILL ALWAYS BE THE CASE IF DPSI IS CALLED ONLY FROM NEWTON, DPSI  6
      COMMON /PSIDPS/ AA,AB,D1,D2,AAA,CATH,ALF,I,R                      DPSI  7
      COMMON/TABLES/ KDEPTH(35),KLASS(35),PSIMAX(25),ALFMAX(25),NN(35),
     1               MM(35),ANORM(25,51),QNORM(25,51),DNORM(25,51),
     2   AFACT(25),  RFACT(25)
      COMMON A(160,2,2),Q(160,2,2),CPOL1(160,2,5),CPOL2(160,2,5),QMAX(16DPSI 11
     10),     QFULL(160), AFULL(160), DXDT(160),C1(160), SLOPE(160),    DPSI 12
     2        DIST(160), GEOM1(160), ROUGH(160), NOE(160), NUE(160,3),  DPSI 13
     3        INUE(160,3), NTYPE(160), JR(160), NKLASS, NE, NDT, EPSIL, DPSI 14
     4        TIME, DT, M, KFULL, N, NOS, NPOLL, NPRINT, ITER,          DPSI 15
     5        QDWF(160), IOLD(160), P1(160), RNOFF(160), QINFIL(160),   DPSI 16
     6        WDWF(160,5), PLUTO(160,5), IR(160), P2(160), NIN(1000),   DPSI 17
     7        P5(160),P6(160),P7(160),SCF(160),BARREL(160),             DPSI 18
     8       TITLE(40), NPE(20), NYN(20), NORDER(70), GEOM2(160),       DPSI 19
     9       GEOM3(160) , P4(160),SCOUR(160), KSTORE(160)              DPSI 20
      COMMON  BODIN( 2,150),SSIN( 2,150),BODOUT,SSOUT,COLIN(2,150),    DPSI 21
     *  QINST,QOUST,QINSTL( 2),QOUSTL( 2),STORL( 2),QOUTO( 2),STORO( 2),DPSI 22
     *  NSTOR,KSTOR,IPRINT( 2),IPOL( 2),IFLOOD( 2),ICOST( 2),DEPMAX( 2),DPSI 23
     *  ATERM( 2,11),AO2DT2( 2,11),BDEPTH( 2,11),BSTOR( 2,11),COLOUT,   DPSI 24
     *  DUMSTR(11),DUMDEP(11),                                          DPSI 25
     *  KTSTEP,VOLIN( 2,150),VOLOUT( 2,150),STOR,CUMIN( 2),CUMOUT( 2),  DPSI 26
     *  SBOD( 2),SSS( 2),SCOL( 2),                                      DPSI 27
     *  ISTMOD( 2),ISTTYP( 2),ISTOUT( 2),                               DPSI 28
     *  QPUMP( 2),DSTART( 2),DSTOP( 2),                                 DPSI 29
     *  DTON( 2),STORMX( 2),DTPUMP( 2),DTMORE( 2),STORF( 2),APLAN( 2),  DPSI 30
     *  CLAND( 2),CSTOR( 2),CPS( 2),CTOTAL( 2),CPCUYD( 2),CPACRE( 2),   DPSI 31
     *  LP,JP,LPREV( 2),LABEL,DETENT(150),FRAC(150),OUT1(10,200)        DPSI 32
      NT = NTYPE(M)                                                     DPSI 33
      IF(NT,EQ,2) GO TO 30                                              DPSI 34
      IF (NT,EQ,10) GO TO 100                                           DPSI 35
      IF (NT,EQ,11) GO TO 110                                           DPSI 36
      IF (NT,EQ,12) GO TO 120                                           DPSI 37
      IF(NT,EQ,13) GO TO 130                                            DPSI 38
C     INCLUDE TABULAR DPSI CALC, IN CASE DPSI IS CALLED BY KLASS=2      DPSI 39
C     CONDUIT,                                                          DPSI 40
      MMM = MM(NT)                                                      DPSI 41
      DALPHA = ANORM(NT,2)-ANORM(NT,1)                                  DPSI 42
      I = ALPHA/DALPHA+1,0                                              DPSI 43
      IF (I,EQ,MMM) I=I-1                                               DPSI 44
      DPSI = (QNORM(NT,I+1)-QNORM(NT,I))/(ANORM(NT,I+1)-ANORM(NT,I))    DPSI 45
      RETURN                                                            DPSI 46
C     SPECIAL FUNCTIONAL FORM FOR RECTANGULAR CONDUITS,                 DPSI 47
   30 CONTINUE                                                          DPSI 48
      IF(ALPHA,LE,0,0) GO TO 45                                         DPSI 49
      IF (ALPHA,GT,ALFMAX(NT)) GO TO 35                                 DPSI 50
      IF (ALPHA,LT,0,0001) GO TO 40                                     DPSI 51
      DPSI = CATH*(P6(M)*ALPHA/AAA+1,666667)                            DPSI 52
      RETURN                                                            DPSI 53
   35 DPSI = (1,0-P4(M))/(1,0-ALFMAX(NT))                               DPSI 54
      RETURN                                                            DPSI 55
   40 IF (ALPHA,LE,1,0E-30) GO TO 45                                    DPSI 56
      DPSI = 1,666667*(ALPHA*P7(M))**0,6666667                          DPSI 57
      RETURN                                                            DPSI 58
   45 DPSI = 1,0E-30                                                    DPSI 59
      RETURN                                                            DPSI 60
C     FUNCTIONAL FORM FOR MODIFIED BASKET-HANDLE,                       DPSI 61
  100 IF (ALPHA,EQ,0,0) GO TO 45                                        DPSI 62
      IF (AA,GT,GEOM3(M)) GO TO 105                                     DPSI 63
      IF (ALF,LT,0,0001) GO TO 103                                      DPSI 64
      DPSI = CATH*(-1,333333*R*ALF/AAA+1,666667)*AFULL(M)/GEOM3(M)      DPSI 65
      RETURN                                                            DPSI 66
  103 DPSI = P6(M)*1,666667*(ALF*P7(M))**0,6666667*AFULL(M)/GEOM3(M)    DPSI 67
      RETURN                                                            DPSI 68
  105 DPSI = (PSI(ALPHA+0,0005)-PSI(ALPHA-0,0005))/0,01                 DPSI 69
      RETURN                                                            DPSI 70
C     FUNCTIONAL FORM FOR RECTANGULAR, TRIANGULAR BOTTOM,               DPSI 71
  110 IF (ALPHA,EQ,0,0) GO TO 45                                        DPSI 72
      IF (AA,GT,AB) GO TO 115                                           DPSI 73
      DPSI = P7(M)*1,333333*ALPHA**0,3333333                            DPSI 74
      RETURN                                                            DPSI 75
  115 IF (ALPHA,GT,ALFMAX(NT)) GO TO 35                                 DPSI 76
      DPSI=CATH*(-0,6666667*ALPHA/AAA*(2,0*GEOM1(M)-GEOM3(M))+1,666667) DPSI 77
      RETURN                                                            DPSI 78
C     FUNCTIONAL FORM FOR RECTANGULAR, ROUND BOTTOM,                    DPSI 79
  120 IF (ALPHA,EQ,0,0) GO TO 45                                        DPSI 80
      IF (AA,GT,P6(M)) GO TO 125                                        DPSI 81
      DPSI = (QNORM(1,I+1)-QNORM(1,I))/0,02*P7(M)                       DPSI 82
      RETURN                                                            DPSI 83
  125 IF (ALPHA,GT,ALFMAX(NT)) GO TO 35                                 DPSI 84
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      DPSI = CATH*(1,666667-1,333333*AFULL(M)/GEOM2(M)/D2)              DPSI  85
      RETURN                                                            DPSI  86
C    FUNCTIONAL FORM FOR TRAPEZOID                                      DPSI  87
  130 IF(ALPHA,EQ,0,0) GO TO 45                                         DPSI  88
      D1 = GEOM2(M) + P5(M) * AAA                                       DPSI  89
      D2 = SQRT(P7(M) + AA)                                             DPSI  90
      AB = GEOM2(M) + P5(M) * GEOM1(M)                                  DPSI  91
      DRDA = AB/D1 * (1,0 - AA * P5(M) * 0,5/D2/D1)                     DPSI  92
      DPSI = (0,6666667 * ALPHA * DRDA + CATH)/CATH**0,3333333          DPSI  93
      RETURN                                                            DPSI  94
      END                                                               DPSI  95
*DECK,FILTH
      SUBROUTINE FILTH                                                  FILT   1
C=======================================================================FILT   2
C     SUBROUTINE TO DETERMINE AVERAGE DAILY DWF QUAL AND QUAN           FILT   3
C     ***                                                               FILT   4
      COMMON/DRWF/ DVDWF(7),DVBOD(7),DVSS(7),HVDWF(24),HVBOD(24),       FILT   5
     1              HVSS(24),HVCOLI(24),KTNUM,KDAY,KHOUR,KMINS          FILT   6
C****    COMMON AREA TABLES REMOVED FROM THIS ROUTINE SINCE IT WAS NOT
C****    BEING USED
C****    DONE BY TS OF EH%A ON  1/25/76      ************************
      COMMON A(160,2,2),Q(160,2,2),CPOL1(160,2,5),CPOL2(160,2,5),QMAX(16FILT  10
     10),     QFULL(160), AFULL(160), DXDT(160),C1(160), SLOPE(160),    FILT  11
     2        DIST(160), GEOM1(160), ROUGH(160), NOE(160), NUE(160,3),  FILT  12
     3        INUE(160,3), NTYPE(160), JR(160), NKLASS, NE, NDT, EPSIL, FILT  13
     4        TIME, DT, M, KFULL, N, NOS, NPOLL, NPRINT, ITER,          FILT  14
     5        QDWF(160), IOLD(160), P1(160), RNOFF(160), QINFIL(160),   FILT  15
     6        WDWF(160,5), PLUTO(160,5), IR(160), P2(160), NIN(1000),   FILT  16
     7        P5(160),P6(160),P7(160),SCF(160),BARREL(160),             FILT  17
     8        TITLE(40), NPE(20), NYN(20), NORDER(70), GEOM2(160),      FILT  18
     9        GEOM3(160) , P4(160),SCOUR(160), KSTORE(160)              FILT  19
      COMMON  BODIN( 2,150),SSIN( 2,150),BODOUT,SSOUT,                  FILT  20
     *  QINST,QOUST,QINSTL( 2),QOUSTL( 2),STORL( 2),QOUTO( 2),STORO( 2),FILT  21
     *  NSTOR,KSTOR,IPRINT( 2),IPOL( 2),IFLOOD( 2),ICOST( 2),DEPMAX( 2),FILT  22
     *  ATERM( 2,11),AO2DT2( 2,11),BDEPTH( 2,11),BSTOR( 2,11),COLOUT,   FILT  23
     *  DUMSTR(11),DUMDEP(11),                                          FILT  24
     *  KTSTEP,VOLIN( 2,150),VOLOUT( 2,150),STOR,CUMIN( 2),CUMOUT( 2),  FILT  25
     *  SBOD( 2),SSS( 2),SCOL( 2),                                      FILT  26
     *  ISTMOD( 2),ISTTYP( 2),ISTOUT( 2),                               FILT  27
     *  QPUMP( 2),DSTART( 2),DSTOP( 2),                                 FILT  28
     *  DTON( 2),STORMX( 2),DTPUMP( 2),DTMORE( 2),STORF( 2),APLAN( 2),  FILT  29
     *  CLAND( 2),CSTOR( 2),CPS( 2),CTOTAL( 2),CPCUYD( 2),CPACRE( 2),   FILT  30
     *  LP,JP,LPREV( 2),LABEL,DETENT(150),FRAC(150),OUT1(10,200)        FILT  31
C     ***                                                               FILT  32
C     ***********************************************************       FILT  33
C     READ DAILY AND HOURLY CORRECTION FACTORS FOR SEWAGE               FILT  34
      IF(NPOLL,GT,0)  READ(5,501) DVDWF,DVBOD,DVSS                      FILT  35
      IF(NPOLL,LT,1)  READ(5,501) DVDWF                                 FILT  36
  501 FORMAT(7F10,0)                                                    FILT  37
      IF(NPOLL,GT,0) READ(5,502) HVDWF,HVBOD,HVSS,HVCOLI                FILT  38
      IF(NPOLL,LT,1) READ(5,502) HVDWF                                  FILT  39
  502 FORMAT (8F10,0)                                                   FILT  40
C                                                                       FILT  41
C**********                                                             FILT  42
C                                                                       FILT  43
C     READ TOTAL NUMBER OF SUBAREAS, TYPE OF FLOW AND QUALITY DATA      FILT  44
C     AVAILABLE, NUMBER OF PROCESS FLOWS, TIME SIMULATION BEGINS( DAY,  FILT  45
C     HOUR, AND MINUTE), CURRENT VALUE OF THE CONSUMER PRICE INDEX,CPI,:FILT  46
C     CURRENT VALUE OF THE COMPOSITE CONSTRUCTION COST INDEX, CCCI      FILT  47
C  POPULA IS THE TOTAL POP IN ALL AREAS IN THOUSANDS                    FILT  48
      READ(5,503) KTNUM,KASE,NPF,KDAY,KHOUR,KMINS,CPI,CCCI,POPULA       FILT  49
  503 FORMAT (6I5,2F5,1,F10,3)                                          FILT  50
      IF(KASE,LE,0) KASE = 1                                            FILT  51
      IF(KDAY,LE,0) KDAY = 1                                            FILT  52
      IF(NPOLL,GT,0) WRITE(6,601)                                       FILT  53
  601 FORMAT('1',27X,'QUANTITY AND QUALITY OF  D W F  FOR EACH SUBAREA'/FILT  54
     1/)
      IF(NPOLL,LT,1) WRITE(6,6001)
 6001 FORMAT('1',10X,'QUANTITY OF  D W F  FOR EACH SUBAREA',//)
C
C*********
C     COMPUTE TOTAL INFILTRATION WITHIN STUDY AREA
      AINFIL=0,0
      DO 415 KK=1,NE
  415 AINFIL= AINFIL+QINFIL(KK)
C     AINFIL=4,4
C
      IF(KASE,NE,1) ADWF=0,0
C  IF KASE = 1 THE AVERAGE FLOW AND CHARACTERISTICS ARE KNOWN FOR THE
C      ENTIRE AREA BUT NOT FOR THE INDIVIDUAL SUBAREAS (EG SEWAGE PLANT
C     DATA)
C  IF KASE = 2 NO SUCH DATA IS AVAILABLE
      IF (KASE.GT,1) GO TO 412
C
C**********KASE 1 FOLLOWS
C
C  ADWF ETC, ARE THE AVE DAILY VALUES OF DRY WEATHER FLOW IN CFS, BOD IN
C     MG/L, SUSP SOLIDS IN MG/L , RESPECTIVELY
C     (FOR EXAMPLE, FROM A TREATMENT PLANT SERVING THE ENTIRE STUDY AREA
      READ(5,504) ADWF,ABOD,ASUSO,ACOLI
  504 FORMAT (3F10.0,E10.2)
C  ACOLI IS THE VALUE OF TOTAL COLIFORMS IN MPN/100ML
C  READ TOTAL AREA TO PLANT, INDUSTRIAL AREA, COMMERCIAL, RESIDENTIAL
C     HIGH INCOME, RESIDENTIAL AVE INCOME, RESIDENTIAL LOW INCOME, RESI-
C     DENTIAL WITH GARBAGE GRINDERS, PARKS AND OPEN AREA - ALL IN ACRE.
C  AND TOTAL POPULATION
      READ (5,505) TOTA, TINA, TCA, TRHA, TRAA, TRLA, TRGGA, TPOA
  505 FORMAT (8F8,0)
C  COMPUTE TOTAL BOD AND SUSPENDED SOLIDS IN POUNDS PER DAY
      IF(NPOLL,LT,1) GO TO 411
      TOTBOD= (ADWF/1,547)*ABOD*8,34
      TOTSS=(ADWF/1,547)*ASUSO*8,34
C  COMPUTE TOTAL COLIFORMS IN MPN/DAY
      TCOLI=ACOLI*ADWF*2,447E+7
C  MAKE DATA CORRECTION FOR INFILTRATION
  411 C1DWF= ADWF- AINFIL
C  MAKE DATA CORRECTION FOR PROCESS FLOWS
C  FIRST INITIALIZE SUMATION QUANTITIES
      SUMQPF=0,0
      SUMBOD=0,0
      SUMSS=0,0
C     NPF IS NUMBER OF PROCESS FLOWS
      IF(NPF,LE,0) GO TO 416
      DO 500 JJ=1,NPF
C  READ PROCESS FLOW CHARACTERISTICS AND LOCATIONS
      READ(5,506) INPUT, QPF, BODPF, SUSPF
  506 FORMAT(I5,6F10,3)
      SUMQPF=SUMQPF + QPF
      IF(NPOLL,LT,1) GO TO 500
      SUMBOD=SUMBOD +(QPF/1,547)*BODPF*8,34
      SUMSS=SUMSS + (QPF/1,547)*SUSPF*8,34
  500 CONTINUE
  416 C2DWF=C1DWF-SUMQPF
      IF(C2DWF,LE,0.0,OR,NPOLL.LT.1) GO TO 412
      C1BOD=TOTBOD-SUMBOD
      C1SS=TOTSS-SUMSS
C   ****
C  MAKE FINAL CORRECTIONS TO ALLOW FOR INCOME VARIATIONS, COMMERCIAL
C     USE, GARBAGE GRINDERS, AND POPULATION
C     COMPUTE RESIDENTIAL AND COMMERCIAL AREA CONTRIBUTING TO PLANT
      TDWFA=TOTA-TINA-TPOA
C  COMPUTE WEIGHTED DWFA BASED ON EXPECTED VARIATIONS IN SEWAGE
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C       STRENGTH,
        WTDWFA= 0,9*TCA+1,2*TRHA+1,0*TRAA+0,8*TRLA+1,3*TRGGA
C  COMPUTE CORRECTION FACTOR TO WEIGHT SEWAGE STRENGTH - NOTE BOD AND
C       SS ARE AFFECTED EQUALLY
        TDTR=TDWFA+TRGGA
        IF(TDTR,LE,0,0) CF=1,0
        IF(TDTR,LE,0,0) GO TO 413
        CF=WTDWFA/TDWFA
C  MODIFY MEASURED STRENGTHS TO PERMIT WEIGHTING IN SUBAREA COMPS
  413 C2BOD=C1BOD/CF
        C2SS=C1SS/CF
        IF(C2BOD,LE,0,0) C2BOD=0,0
        IF(C2SS,LE,0,0) C2SS= 0,0
C    ***
C  COMPUTE AVERAGE CORRECTED AND WEIGHTED DWF CHARACTERISTICS IN
C       LBS/DAY/CFS,
        A1BOD=C2BOD/C2DWF
        A1SS=C2SS/C2DWF
        A1COLI=TCOLI/(POPULA*1000,)
C  A1COLI IS THE AVERAGE NUMBER OF COLI PER CAPITA PER DAY
        GO TO 414
C
C**********KASE 2 FOLLOWS
C
C  IN THE EVENT MEASURED FLOW CHARACTERISTICS ARE NOT AVAILABLE ASSUME
C       FOR A1BOD,  A1SS, AND A1COLI
  412 IF(NPOLL,LT,1) GO TO 4012
        A1BOD=1300,
C  THIS ASSUMES 85 CAL/CAP/DAY AND 0,20LBS/CAP/DAY FOR AVE INCOME
        A1SS=1420,
C  THIS ASSUMES 85 GAL/CAP/DAY AND 0,22 LBS/CAP/DAY FOR AVE INCOME
        A1COLI=2,00E+11
C  A1COLI,MPN/DAY/CAP, ASSUMES 200 BILLION COLIFORMS PER CAPITA PER DAY
 4012 ADWF=POPULA*1000,*1,547*100,/1000000,
C  THIS ASSUMES 100 GAL/CAP/DAY INCLUDING INFILTRATION
C
C**********
C
  414 IF(NPOLL,GT,0) WRITE(6,602) A1BOD,A1SS,A1COLI,ADWF
  602 FORMAT ('0',T10,'A1BOD  =',F11,2,' LBS/DAY/CFS',/,T10,
     1'A1SS    =',F11,2,' LBS/DAY/CFS',/,T10,'A1COLI =',1PE11,2,
     2' MPN/DAY PER CAPITA',/,T10,'ADWF    =',0PF11,2,' CFS',//)
      IF(NPOLL,LT,1) WRITE(6,6002) ADWF
 6002 FORMAT('0',15X, 'ADWF =', F8,3,' CFS',//)
C    ***
      SMMDWF=0.00
      SMMBOD=0,00
      SMMSS=0,00
      TOTPOP=0,0
      SMMQQ=0,0
      IF(NPOLL,GT,0) WRITE(6,603)
  603 FORMAT (3X ,'KNUM',1X,'INPUT',5X,'DWF',2X,'+',2X,'INFIL',2X,'=',2X
     *,'QQDWF',3X,'KLAND',2X,'DWBOD',7X,'DWSS',9X,'TOTPOP',3X,'BODCONC'
     ,,4X,'SSCONC',4X,' COLIFORMS')
      IF(NPOLL,GT,0) WRITE(6,604)
  604 FORMAT (' ',17X,'CFS',6X,'CFS',7X,'CFS',11X,'LBS/MIN',4X,'LBS/MIN'
     , ,7X,'PERSONS',5X,'MG/L',6X,'MG/L',5X,' MPN/100ML'//)
      IF(NPOLL,LT,1) WRITE(6,6004)
 6004 FORMAT (3X ,'KNUM',1X,'INPUT',5X,'DWF',2X,'+',2X,'INFIL',2X,'=',2X
     1,'QQDWF',3X,'KLAND',/,18X,'CFS',6X,'CFS',7X,'CFS',//)
      QQ=0,0
      QQDWF=0,0
      SMTDWF=0,0
C
C**********TIMESTEP COMPUTATIONS FOLLOW
C**********FLOW
```

```
C
      DO 300 I=1,KTNUM
      DWF=0,0
C     COMPUTE DWF FOR EACH SUBAREA
C     SUBAREAS IN A CITY ARE CHOSEN PRIMARILY ON LAND USE CRITERIA
      READ(5,507)KNUM,INPUT,KLAND,METHOD,KUNIT,WATER,PRICE,SEWAGE,ASUB,
     1POPDEN,DWLNGS,FAMILY,VALUE,PCGG,SAQPF,SABPF,SASPF,XINCOM,MSUBT
  507 FORMAT(2I3,3I1,13F5.1,I2)
      IF(KLAND,LE,0) KLAND = 5
      IF(METHOD,LE,0) METHOD = 2
C     DATA CHECK AND ASSUMPTIONS NECESSARY TO OVERCOME MISSING DATA
C     IF HOUSE VALUATION(VALUE) IS UNDEFINED, ASSUME $20,000 HOMES
      IF(VALUE,LE,0) VALUE = 20,0
C     CHECK ON WHETHER POPULATION DENSITY OR THE NUMBER OF DWELLINGS
C     FOR EACH SUBAREA ARE INCLUDED AS INPUT DATA
C     CORRECT VALUE TO 1960 DOLLARS USING DEPARTMENT OF INTERIOR
C     COMPOSITE CONSTRUCTION COST INDEX(1960 VALUE OF CCCI=103,0)
      IF(CCCI,LE,0,0) CCCI= 103,0
      VALUE= VALUE*103,0/CCCI
      IF(DWLNGS,GT,0,0) GO TO 130
      IF(POPDEN,GT,0,0) GO TO 115
C     IF BOTH POPULATION DENSITY AND NUMBER OF DWELLINGS PER SUBAREA
C     ARE NOT TABULATED, ASSUME 10 DWELLING UNITS PER ACRE
  114 DWLNGS=10,0*ASUB
      GO TO 130
C     IF POPULATION DENSITY BUT NOT NUMBER PER HOUSEHOLD(FAMILY) IS
C     TABULATED, ASSUME FAMILY=3,0
  115 IF(FAMILY,LE,0,0) FAMILY = 3,0
      DWLNGS=POPDEN*ASUB/FAMILY
C     METHOD USED TO ESTIMATE D W F WITH MEASURED SEWAGE OR WATER FLOWS
  130 IF(SEWAGE,GT,0,0) GO TO 136
      IF(WATER,LE,0,0) GO TO 100
C     CHECK UNITS OF WATER DATA AND USE APPROPRIATE CONVERSION FACTOR
      IF(KUNIT,LE,0) GO TO 135
      DWF=WATER/(30,4*24,*3600,)*1000,
      GO TO 200
  135 DWF=WATER/(30,4*24,*3600,)*0.134*1000,
      GO TO 200
  136 DWF=SEWAGE
      GO TO 200
C     GO TO APPROPRIATE DWF ESTIMATE DEPENDING ON TYPE OF LAND USE
C     TYPE 1 SINGLE FAMILY RESIDENTIAL
C     TYPE 2 MULTI-FAMILY RESIDENTIAL
C     TYPE 3 COMMERCIAL
C     TYPE 4 INDUSTRIAL
C     TYPE 5 UNDEVELOPED OR PARKLANDS
  100 GO TO(10,20,30,40,50),KLAND
C     METHOD TO ESTIMATE DWF IN SINGLE FAMILY RESIDENTIAL SUBAREAS
C     CHECK ON WHETHER PRICE OF WATER IS INCLUDED AS INPUT DATA
C     THIS DETERMINES WHICH OF LINAWEAVER'S EQUATION TO USE
C     LINAWEAVER'S EQUATIONS ALSO DEPEND ON WHETHER WATER IS METERED
C     ASSUME FLAT RATE PRICING IF METERING IS NOT INDICATED IN DATA
   10 IF(METHOD,NE,1) GO TO 20
      IF(PRICE,GT,0,0) GO TO 13
C     EQUATION 1 LINAWEAVER
      DWF=(178,+3,28*VALUE)*DWLNGS*0,134/(24,*3600,)
      GO TO 200
C     EQUATION 2 METERED WITH PUBLIC SEWER LINAWEAVER AND HOWE
C     CORRECT PRICE TO 1965 DOLLARS USING THE CONSUMER PRICE INDEX
C     (1965 CPI=109,0)
   13 IF (CPI,LE,0.0) CPI= 109,9
      PRICE= PRICE*109,9/CPI
      DWF=(206,+3,47*VALUE-1.30*PRICE)*DWLNGS*0,134/(24,*3600,)
      GO TO 200
C     METHOD TO ESTIMATE DWF IN MULTI-FAMILY RESIDENTIAL SUBAREAS
C     CHECK ON WHETHER VALUE AND FAMILY ARE INCLUDED AS INPUT DATA
```

```
   20 IF(FAMILY,GT,0,0) GO TO 22                                        FILT253
      FAMILY=3,0                                                        FILT254
C     EQUATION 3 FLAT RATE AND APARTMENTS WITH PUBLIC SEWER L, AND H,   FILT255
   22 DWF=(28,9+4,39*VALUE+33.6*FAMILY)*DWLNGS*0,134/(24,*3600,)        FILT256
      GO TO 200                                                         FILT257
C     DWF MODEL REQUIRES WATER OR SEWAGE INPUTS                         FILT258
C     TO ESTIMATE DWF FOR COMMERCIAL OR INDUSTRIAL SUBAREAS             FILT259
   30 DWF=DWF+SAQPF                                                     FILT260
      GO TO 200                                                         FILT261
   40 DWF=DWF+SAQPF                                                     FILT262
      GO TO 200                                                         FILT263
   50 DWF=0,0                                                           FILT264
  200 CONTINUE                                                          FILT265
      POP=ASUB*POPDEN                                                   FILT266
      TOTPOP=TOTPOP+POP                                                 FILT267
      IF(ADWF,LE,0,0) QQF=0,0                                           FILT268
      IF(ADWF,GT,0,0) QQF=AINFIL/ADWF                                   FILT269
      QQ=QQF*DWF                                                        FILT270
      IF(KLAND,NE,4) QQ=QQF*DWF                                         FILT271
      IF(KLAND,EQ,4) QQ=0,0                                             FILT272
      QQDWF=DWF+QQ                                                      FILT273
C                                                                       FILT274
      IF(NPOLL,LT,1) GO TO 6005                                         FILT275
C                                                                       FILT276
C**********QUALITY                                                      FILT277
C                                                                       FILT278
C     COMPUTE DWF QUALITY FOR EACH SUBAREA                              FILT279
C     DAILY QUALITY AVERAGES ARE CONVERTED TO SUBAREA QUALITY RATES     FILT280
C     (LBS/SEC)                                                         FILT281
  201 CONTINUE                                                          FILT282
      C1DT=DT/(24,0*60,0*60,0)                                          FILT283
      IF(XINCOM,LE,0,0) XINCOM=VALUE/2,5                                FILT264
      IF (KLAND,LE,2) GO TO 421                                         FILT285
      IF(KLAND,EQ,3) GO TO 422                                          FILT286
      IF (KLAND,EQ,4) GO TO 423                                         FILT287
  424 DWBOD=DWF*A1BOD*C1DT                                              FILT288
      DWSS=DWF*A1SS*C1DT                                                FILT289
      GO TO 25                                                          FILT290
  422 DWBOD=DWF*0,9*A1BOD*C1DT                                          FILT291
      DWSS=DWF*0,9*A1SS*C1DT                                            FILT292
      GO TO 25                                                          FILT293
  423 DWBOD=(SAQPF/1,547)*SABPF*8,34*C1DT                               FILT294
      DWSS=(SAQPF/1,547)*SASPF*8,34*C1DT                                FILT295
      GO TO 25                                                          FILT296
C  COMPUTE RESIDENTIAL STRENGTHS ON THE BASIS OF INCOME AND GARBAGE     FILT297
C     GRINDERS,                                                         FILT298
  421 DWBOD=DWF*A1BOD*C1DT                                              FILT299
      DWSS=DWF*A1SS*C1DT                                                FILT300
      IF(XINCOM,GT,15,) DWBOD=1,2*DWBOD                                 FILT301
      IF (XINCOM,GT,15,)DWSS=1,2*DWSS                                   FILT302
      IF(XINCOM,LT,7,)DWBOD =0,8*DWBOD                                  FILT303
      IF(XINCOM,LT,7,) DWSS=0,8*DWSS                                    FILT304
      DWBOD=DWBOD+(0,3*PCGG*DWBOD)/100,                                 FILT305
      DWSS=DWSS+(0,3*PCGG*DWSS)/100,                                    FILT306
   25 DW1BOD=DWBOD*60,/DT                                               FILT307
      DW1SS=DWSS*60,/DT                                                 FILT308
      WRITE(6,605) KNUM,INPUT,DWF,QQ,QQDWF,KLAND,DW1BOD,DW1SS           FILT309
 6005 IF(NPOLL,LT,1) WRITE(6,605) KNUM,INPUT,DWF,QQ,QQDWF,KLAND         FILT310
  605 FORMAT(' ',2I5,     3F10,3,I6,1F11,2,1F11,2)                      FILT311
C  COMPUTE TOTAL QUANTITIES IN SYSTEM                                   FILT312
      SMMDWF=SMMDWF+ DWF                                                FILT313
      SMMQQ=SMMQQ+QQ                                                    FILT314
      SMTDWF=SMMQQ+SMMDWF                                               FILT315
      IF(NPOLL,LT,1) GO TO 4028                                         FILT316
      SMMBOD=SMMBOD + DWBOD                                             FILT317
      SMMSS=SMMSS + DWSS                                                FILT318
      IF(SMTDWF,LE,0,0) DWCOLI=0,0                                      FILT319
      IF(SMTDWF,GT,0,0) DWCOLI=A1COLI*TOTPOP/(SMTDWF*2,447E+7)          FILT320
      D2COLI=A1COLI*POP/(60,*24,*60,)                                   FILT321
C  D2COLI  IS THE TOTAL DWF COLI FROM THE ASUB IN MPN/SEC               FILT322
      INPUT=NIN(INPUT)                                                  FILT323
      WDWF(INPUT,1)=(DWBOD/DT)+WDWF(INPUT,1)                            FILT324
      WDWF(INPUT,2)=(DWSS/DT)+WDWF(INPUT,2)                             FILT325
       WDWF(INPUT,3)=D2COLI+WDWF(INPUT,3)                               FILT326
      IF(MSUBT,LE,0) GO TO 800                                          FILT327
      IF(SMTDWF,LE,1,0E-15)GO TO 428                                    FILT328
      BODCON=(SMMBOD*1000000,)/(SMTDWF*DT*7,48*8,34)                    FILT329
      SSCONC=(SMMSS*1000000,)/(SMTDWF*DT*7,48*8,34)                     FILT330
  428 WRITE(6,606) SMMDWF,SMMQQ,SMTDWF,SMMBOD,SMMSS,TOTPOP,BODCON,SSCONCFILT331
     ,,DWCOLI                                                           FILT332
  606 FORMAT('0',10X,'SUBTOTALS'//11X,3F10.2,6X,1F11,2,' LBS', 1F7,2,' LFILT333
     *BS',3F10,0,3X,1PE10,2//)                                          FILT334
 4028 IF(NPOLL,LT,1,AND,MSUBT,GT,0) WRITE(6,6006) SMMDWF,SMMQQ,SMTDWF   FILT335
 6006 FORMAT('0',10X,'SUBTOTALS'//11X,3F10,3,//)                        FILT336
  800 CONTINUE                                                          FILT337
      QDWF(INPUT)=QDWF(INPUT)+DWF                                       FILT338
  300 CONTINUE                                                          FILT339
C                                                                       FILT340
C**********END OF TIMESTEP COMPUTATION                                  FILT341
C                                                                       FILT342
      IF(NPOLL,LT,1) GO TO 6007                                         FILT343
      BODCON=(SMMBOD*1000000,)/(SMTDWF*DT*7,48*8,34)                    FILT344
      SSCONC=(SMMSS*1000000,)/(SMTDWF*DT*7,48*8,34)                     FILT345
      WRITE (6,607) SMMDWF,SMMQQ,SMTDWF,SMMBOD,SMMSS,TOTPOP,BODCON,     FILT346
     1SSCONC, DWCOLI                                                    FILT347
  607 FORMAT ('0',10X,'TOTALS'//11X,3F10,2,6X,1F11,2,' LBS', 1F7,2,' LBSFILT348
     *',3F10,0,3X,1PE10,2)                                              FILT349
 6007 IF(NPOLL,LT,1) WRITE(6,6017) SMMDWF,SMMQQ,SMTDWF                  FILT350
 6017 FORMAT ('0',10X,'TOTALS'//11X,3F10,3)                             FILT351
C**********                                                             FILT352
C                                                                       FILT353
      IF(KASE,NE,1) GO TO 430                                           FILT354
      IF(ADWF,EQ,0,) GO TO 430                                          FILT355
      CF2= ADWF/SMTDWF                                                  FILT356
      IF(NPOLL,GT,0) WRITE(6,608) ADWF,SMTDWF,CF2                       FILT357
  608 FORMAT(/' COMPARISON OF MEASURED AND CALCULATED TOTAL SEWAGE',   'FILT358
     1 FLOW:  ADWF =',F6,2,' CFS  SMTDWF ='F6,2,' CFS'/' CORRECTION FACTFILT359
     *OR (CF2) OF',F6,2,' APPLIED TO THE DWF (QUANTITY AND QUALITY) AT EFILT360
     *ACH INLET')                                                       FILT361
      IF(NPOLL,LT,1) WRITE(6,6008)ADWF,SMTDWF,CF2                       FILT362
 6008 FORMAT(/' COMPARISON OF MEASURED AND CALCULATED TOTAL SEWAGE',   'FILT363
     1 FLOW:  ADWF =',F6,2,' CFS  SMTDWF ='F6,2,' CFS'/' CORRECTION FACTFILT364
     2OR (CF2) OF',F6,2,' APPLIED TO THE  D W F  (QUANTITY) AT EACH INLEFILT365
     3T')                                                               FILT366
      GO TO 431                                                         FILT367
  430 CF2=1,                                                            FILT368
C     CORRECTION FACTOR (CF2) APPLIED TO THE DWF (QUANTITY AND QUALITY) FILT369
C     WHEN ADWF IS MEASURED (KASE=1)                                    FILT370
  431 DO 432 I=1,NE                                                     FILT371
      IF(NPOLL,LT,1) GO TO 432                                          FILT372
      WDWF(I,1)=WDWF(I,1)*CF2                                           FILT373
      WDWF(I,2)=WDWF(I,2)*CF2                                           FILT374
      WDWF(I,3)=WDWF(I,3)*CF2                                           FILT375
  432 QDWF(I)=QDWF(I)*CF2                                               FILT376
C                                                                       FILT377
C**********                                                             FILT378
C                                                                       FILT379
C     DAILY AND HOURLY CORRECTION FACTORS APPLIED WITHIN TRANSPORT MODELFILT380
      IF(NPOLL,GT,0) WRITE(6,609)                                       FILT381
  609 FORMAT('1',T40,'DAILY AND HOURLY CORRECTION FACTORS',/T51         FILT382
     1,'FOR SEWAGE DATA'//,T36,'DAY',T50,'DVDWF',T60,'DVBOD',           FILT383
     2T70,'DVSS',T80,'DVCOLI'/)                                         FILT384
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      IF(NPOLL,LT,1) WRITE(6,6009)                                      FILT385
 6009 FORMAT('1',T25,'DAILY AND HOURLY CORRECTION FACTORS',/T36         FILT386
     1,'FOR SEWAGE DATA'//,T36,'DAY',T50,'DVDWF',/)                     FILT387
      IF(NPOLL,GT,0) WRITE(6,610) (I,DVDWF(I),DVBOD(I),DVSS(I),I=1,7)   FILT388
  610 FORMAT(T35,I3,7X,3F10,3)                                          FILT389
      IF(NPOLL,LT,1) WRITE(6,6100)(I,DVDWF(I),I=1,7)                    FILT390
 6100 FORMAT(T35,I3,7X,F10,3)                                           FILT391
      WRITE(6,611)                                                      FILT392
  611 FORMAT('0',T35,'HOUR'/)                                           FILT393
      IF(NPOLL,GT,0) WRITE(6,612) (I,HVDWF(I),HVBOD(I),HVSS(I),HVCOLI(I)FILT394
     1,I=1,24)                                                          FILT395
  612 FORMAT(T35,I3,7X,4F10,3)                                          FILT396
      IF(NPOLL,LT,1) WRITE(6,6120)(I,HVDWF(I),I=1,24)                   FILT397
 6120 FORMAT(T35,I3,7X,F10,3)                                           FILT398
      RETURN                                                            FILT399
      END                                                               FILT400
*DECK,INFIL
      SUBROUTINE INFIL                                                  INFI   1
C=================================================================INFI   2
      COMMON/TABLES/ KDEPTH(35),KLASS(35),PSIMAX(25),ALFMAX(25),NN(35),
     1               MM(35),ANORM(25,51),QNORM(25,51),DNORM(25,51),
     2   AFACT(25),  RFACT(25)
C****    COMMON AREA NAMES  REMOVED FROM THIS ROUTINE SINCE IT WAS NOT
C****    BEING USED
C****    DONE BY TS OF EH%A ON  1/25/76      ***********************
      COMMON A(160,2,2),Q(160,2,2),CPOL1(160,2,5),CPOL2(160,2,5),QMAX(16INFI   7
     10),     QFULL(160), AFULL(160), DXDT(160),C1(160), SLOPE(160),    INFI   8
     2        DIST(160), GEOM1(160), ROUGH(160), NOE(160), NUE(160,3),  INFI   9
     3        INUE(160,3), NTYPE(160), JR(160), NKLASS, NE, NDT, EPSIL, INFI  10
     4        TIME, DT, M, KFULL, N, NOS, NPOLL, NPRINT, ITER,          INFI  11
     5        QDWF(160), IOLD(160), P1(160), RNOFF(160), QINFIL(160),   INFI  12
     6        WDWF(160,5), PLUTO(160,5), IR(160), P2(160), NIN(1000),   INFI  13
     7        P5(160),P6(160),P7(160),SCF(160),BARREL(160),             INFI  14
     8        TITLE(40), NPE(20), NYN(20), NORDER(70), GEOM2(160),      INFI  15
     9        GEOM3(160) , P4(160),SCOUR(160), KSTORE(160)              INFI  16
C     SUBROUTINE TO ESTIMATE AND ALLOCATE SEWER INFILTRATION            INFI  17
      DIMENSION NDD(12),NDXDAY(360)                                     INFI  18
      READ(5,500) DINFIL,GINFIL,RINFIL                                  INFI  19
      READ(5,501) NDYUD,RSMAX,ULEN                                      INFI  20
   15 READ(5,510) (NDD(I),I=1,12)                                       INFI  21
      SINFIL=0,0                                                        INFI  22
      IF(GINFIL)10,10,50                                                INFI  23
   10 SUMINF=DINFIL+RINFIL                                              INFI  24
      IF(SUMINF,EQ,0,0)WRITE(6,600)                                     INFI  25
      IF(RSMAX,LE,0,0) GO TO 200                                        INFI  26
      MFREZ=0                                                           INFI  27
      MLTBE=0                                                           INFI  28
      MLTEN=0                                                           INFI  29
C     PLACE MONTHLY VALUES AT MIDDLE OF MONTH                           INFI  30
      II=0                                                              INFI  31
      DO 100 I=1,12                                                     INFI  32
      NDDAY=II+15                                                       INFI  33
      NDXDAY(NDDAY)=NDD(I)                                              INFI  34
      II=II+30                                                          INFI  35
  100 CONTINUE                                                          INFI  36
C     INTERPOLATE FOR FIRST AND LAST 15 DAYS OF 'YEAR'                  INFI  37
      NX=345                                                            INFI  38
      NY1=NDXDAY(345)                                                   INFI  39
      NY2=NDXDAY(15)                                                    INFI  40
      NX1=345                                                           INFI  41
      NX2=375                                                           INFI  42
      DO 110 I=1,30                                                     INFI  43
      NX=NX+1                                                           INFI  44
      NY=((NY2-NY1)*(NX-NX1))/30 + NY1                                  INFI  45
      NDXDAY(NX)=NY                                                     INFI  46
  110 CONTINUE                                                          INFI  47
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C     CONVERT LAST 15 DAYS TO FIRST 15                                  INFI 48
      NX=360                                                            INFI 49
      DO 120 I=1,15                                                     INFI 50
      NX=NX+1                                                           INFI 51
      NDXDAY(I)=NDXDAY(NX)                                              INFI 52
  120 CONTINUE                                                          INFI 53
C     INTERPOLATE FROM NDDAY=16 THRU NDDAY=344                          INFI 54
      K=1                                                               INFI 55
      NX=16                                                             INFI 56
      NX1=15                                                            INFI 57
      NX2=45                                                            INFI 58
  130 NY1=NDXDAY(NX1)                                                   INFI 59
      NY2=NDXDAY(NX2)                                                   INFI 60
      NY=((NY2-NY1)*(NX-NX1))/30 +NY1                                   INFI 61
      NDXDAY(NX)=NY                                                     INFI 62
      K=K+1                                                             INFI 63
      NX=NX+1                                                           INFI 64
      IF(K,LE,30) GO TO 130                                             INFI 65
      NX1=NX1+30                                                        INFI 66
      NX2=NX2+30                                                        INFI 67
      K=1                                                               INFI 68
      IF(NX2,LE,345) GO TO 130                                          INFI 69
C     DETERMINE BEGINNING OF FREEZING PERIOD(MFREZ)                     INFI 70
      DO 150 I=1,360                                                    INFI 71
      IF(NDXDAY(I),GT,750) GO TO 160                                    INFI 72
  150 CONTINUE                                                          INFI 73
  160 MFREZ=I                                                           INFI 74
C     IF STORM DAY IS PRIOR TO FREEZING, SET SINFIL=0,0                 INFI 75
      IF(NDYUD.LE,MFREZ) GO TO 200                                      INFI 76
C     STORM OCCURED AFTER FREEZING BEGAN                                INFI 77
      NTOT=0                                                            INFI 78
      DO 170 I=MFREZ,360                                                INFI 79
      IF(NDXDAY(I).LE,750) GO TO 175                                    INFI 80
  170 NTOT=NTOT+(NDXDAY(I)-750)                                         INFI 81
  175 NAREA1=NTOT                                                       INFI 82
      MLTBE=I                                                           INFI 83
      NTOT=0                                                            INFI 84
      IF(NDYUD,LT,MLTBE) GO TO 200                                      INFI 85
      DO 180 I=MLTBE,360                                                INFI 86
      NTOT=NTOT+(750-NDXDAY(I))                                         INFI 87
      IF(NTOT,GE,NAREA1) GO TO 185                                      INFI 88
  180 CONTINUE                                                          INFI 89
C     IF EQUAL AREA MOT REACHED SET MLTEN=360                           INFI 90
  185 MLTEN=I                                                           INFI 91
      IF(NDYUD,GE,MLTEN) GO TO 200                                      INFI 92
C     CALCULATE SINFIL                                                  INFI 93
      XMLTBE=FLOAT(MLTBE)                                               INFI 94
      XNDYUD=FLOAT(NDYUD)                                               INFI 95
      XMLTEN=FLOAT(MLTEN)                                               INFI 96
      XXARG= ((XNDYUD-XMLTBE)/(XMLTEN-XMLTBE))*3,1416                   INFI 97
      SINFIL=RSMAX*SIN(XXARG)                                           INFI 98
      GO TO 40                                                          INFI 99
  200 SINFIL=0,0                                                        INFI100
   40 QINF=RINFIL+SINFIL+DINFIL                                         INFI101
      GO TO 60                                                          INFI102
   50 QINF=GINFIL                                                       INFI103
   60 CONTINUE                                                          INFI104
      OPINF=0,0                                                         INFI105
      IF(ULEN,LE,0.0)ULEN=6,0                                           INFI106
      ATERM=SQRT(4,0*3,1416)/ULEN                                       INFI107
      OPNFIL=0,0                                                        INFI108
      DO 70 K=1,NE                                                      INFI109
      M=JR(K)                                                           INFI110
      NT=NTYPE(M)                                                       INFI111
      IF(KLASS(NT),GT,2)GO TO 70                                        INFI112
      OPINF=ATERM*SQRT(AFULL(M))*DIST(M)+OPINF                          INFI113
   70 CONTINUE
      WRITE(6,615)
      WRITE(6,620)DINFIL,GINFIL,SINFIL,RINFIL
      WRITE(6,630)
      DO 80 K=1,NE
      M=JR(K)
      NT=NTYPE(M)
      IF(KLASS(NT),GT,2)GO TO 80
      OPNFIL=ATERM*SQRT(AFULL(M))*DIST(M)
      OP=OPNFIL/OPINF
      QINFIL(M)=QINF*OP/448,8
      MI=INUE(M,1)
      QINFIL(MI)=QINFIL(MI)+QINFIL(M)
      WRITE(6,640)NOE(M),QINFIL(M),OP,NOE(MI)
      QINFIL(M)=0,0
   80 CONTINUE
  500 FORMAT(10F8,1)
  501 FORMAT(I5,6F8,1)
  510 FORMAT(16I5)
  600 FORMAT('1 NO FLOW ESTIMATES FOR DINFIL OR RINFIL WERE INCLUDED'//)
  615 FORMAT('1',20X,'TOTAL AREA INFILTRATION(IN GPM) DUE TO:'//,
     110X,'BASE FLOW',5X,'GROUND WATER',11X,'MELT    ',5X,'  RAIN'/)
  620 FORMAT(10X,F10,4,5X,F10,4,9X,F10,4,6X,F10,4,//)
  630 FORMAT('0',20X,'APPORTIONED INFILTRATION'//,T68,'INFIL, INPUT AT'/
     1,10X,'ELEMENT NO,',7X,'QINFIL(CFS)',9X,'PROP. TOT. INFIL.',T68,
     2'UPSTREAM ELE. NO,',/)
  640 FORMAT(' ',10X,I5,10X,F10,3,14X,F8,4,T73,I5)
  660 FORMAT(' ',2I5)
      RETURN
      END
*DECK,RADH
      FUNCTION RADH(AA)
C=====================================================================
C     FUNCTION TO COMPUTE THE HYDRAULIC RADIUS FOR A GIVEN FLOW AREA,
      COMMON/TABLES/ KDEPTH(35),KLASS(35),PSIMAX(25),ALFMAX(25),NN(35),
     1                MM(35),ANORM(25,51),QNORM(25,51),DNORM(25,51),
     2   AFACT(25),  RFACT(25)
      COMMON A(160,2,2),Q(160,2,2),CPOL1(160,2,5),CPOL2(160,2,5),QMAX(16
     10),     QFULL(160), AFULL(160), DXDT(160),C1(160), SLOPE(160),
     2         DIST(160), GEOM1(160), ROUGH(160), NOE(160), NUE(160,3),
     3         INUE(160,3), NTYPE(160), JR(160), NKLASS, NE, NDT, EPSIL,
     4         TIME, DT, M, KFULL, N, NOS, NPOLL, NPRINT, ITER,
     5         QDWF(160), IOLD(160), P1(160), RNOFF(160), QINFIL(160),
     6         WDWF(160,5), PLUTO(160,5), IR(160), P2(160), NIN(1000),
     7         P5(160),P6(160),P7(160),SCF(160),BARREL(160),
     8         TITLE(40), NPE(20), NYN(20), NORDER(70), GEOM2(160),
     9         GEOM3(160) , P4(160),SCOUR(160), KSTORE(160)
C     PARAMETERS NEEDED ARE:
C
C        AA= AREA OF FLOW FOR WHICH RADH IS TO BE CALCULATED
C
      REAL L1
      NT=NTYPE(M)
      AF=AFULL(M)
      IF(AA,LE,0,0) GO TO 330
      GO TO (100,300,400,400,400,400,400,400,400,500,520,540,600,
C****    NEXT CARD CHANGED BY TS OF EH%A ON  1/25/76        *************
     1 400,400,400,400,400,400,400,400,400,400,400,400,
C****    NEXT CARD ADDED BY TS OF EH%A ON  1/25/76          *************
     2 200,200,200,200,200,200,200,200,200,200), NT
C     CIRCULAR PIPE
  100 DIAM=GEOM1(M)
  105 ALPHA=AA/AF
      DALPHA=ANORM(1,2)-ANORM(1,1)
      I=ALPHA/DALPHA +1,0
      D1=DNORM(1,I)+(ALPHA-ANORM(1,I))/DALPHA*(DNORM(1,I+1)-DNORM(1,I))
      PROGRAM PORPAV
C*** INPUT AND OUTPUT TAPE COMMON BLOCKS
      COMMON/TAPES/INCNT,IOUTCNT,JIN(10),JOUT(10),NSCRAT(5)
      DIMENSION TITLE(40),SURF(150),DRAIN(150)
      DIMENSION C(5),S(5),L(5),W(5),RAIN(100)
      DIMENSION KI(100),VE(100),QE(100),TE(100),VO(100)
      DIMENSION Q(5,150),SUMQ(5,150),RUNOFF(5,150),INFLOW(150)
      REAL L,KP,KS,KG,KD,KO,KI,INFLOW,INFLOP,KPT,KGT,KST,KDT
      DATA INFLOW/150*0,0/
C*** 760514 TAPE UNIT NUMBER FOR OUTPUT TAPE
      IOUTCNT=IOUTCNT+1
      INCNT=INCNT+1
      NOUT=JOUT(IOUTCNT)
      READ(5,11)TITLE
      WRITE(6,50)TITLE
C***  IZ = 0  TO PRINT IZZARDS CONST AND HYDROGRAPH
C***   FOR EACH RAIN INCREMENT
      READ(5,10) IAREA, NRAIN, KSTEP, JRUNOF,IGUTTN,IZ
      WRITE(6,52) IAREA, NRAIN, KSTEP, JRUNOF,IGUTTN
      READ(5,15) (C(I), S(I), L(I), W(I), I=1,IAREA)
      WRITE(6,54)
      WRITE(6,56) (I, C(I), S(I), L(I), W(I), I=1,IAREA)
      IF (JRUNOF,EQ,0) GO TO 14
      READ(5,20) (INFLOW(J), J=1,JRUNOF)
      GO TO 16
   14 READ(5,20) (RAIN(N), N=1,NRAIN)
      WRITE(6,58)
      WRITE(6,60)(RAIN(N), N=1,NRAIN)
   16 READ(5,25) TSTHR, TSTMIN, TI
C***  760524  TIME STEP NEEDS TO AGREE WITH RUNOFF AND
C***          TRANSPORT BLOCKS        EFA
      WRITE(6,61)TI
      READ(5,30) NEVAP, EVAP
      WRITE(6,62) TSTHR, TSTMIN, NEVAP, EVAP
      READ(5,35) KP,DP,PORP, KS,DS,PORS, KG,DG,PORG, KD,DD
      READ(5,40) WID,XLEN,SPAVE,DSLEN,XN,CWEIR,LWEIR,ISEAL
      READ(5,40) SURDEP,STORP,STORS,STORG,DEDDEP,STRCON
      STMXP=PORP*DP/100,0
      STMXS=PORS*DS/100,0
      STMXG=PORG*DG/100,0
      WRITE(6,80) KP,DP,PORP,STORP,STMXP
      WRITE(6,82) KS,DS,PORS,STORS,STMXS
      WRITE(6,84) KG,DG,PORG,STORG,STMXG
      WRITE(6,85)KD,DD
      WRITE(6,86) WID,XLEN,SPAVE,DSLEN,XN,CWEIR,DEDDEP,SURDEP
      IF (NRAIN,EQ,0) GO TO 200
      DO 100 I=1,IAREA
      KO = C(I) / (S(I)**0,333)
      DO 110 N=1,NRAIN
      IF(RAIN(N),NE,0,)  GO TO 150
      DO 151 K=1,KSTEP
  151 Q(I,K) = 0,
      GO TO 152
C     COMPUTATION OF IZZARD'S CONSTANTS FOR EACH RAIN INCREMENT
  150 KI(N)=((0,0007*RAIN(N))+C(I))/(S(I)**0,333)
      VE(N)=(KI(N)*(L(I)**1,33)*(RAIN(N)*0,333))/35,1
      QE(N)=(RAIN(N)*L(I))/43200,0
      TE(N)=(2,0*VE(N))/(60,0*QE(N))
      VO(N)=L(I)*KO*(QE(N)**0,333)
C     COMPUTE HYDROGRAPH FOR EACH RAIN INCREMENT
```

```
      T=0,0
      TTE=0,0
      X=0,0
      Y=0,0
      QQE=0,0
      TA=0,0
      BETA=0,0
      DO 120 K=1,KSTEP
      T=TI*K
      TTE=T/TE(N)
      IF(TTE,GE,0,15) GO TO 122
      X=ALOG(TTE)
      Y=(32,2*X)-8,36
      QQE=EXP(Y)
      GO TO 132
  122 IF(TTE,GE,0,35) GO TO 124
      X=ALOG(TTE)
      Y=(11,64*X)-5,203
      QQE=EXP(Y)
      GO TO 132
  124 IF(TTE,GE,0,55) GO TO 126
      QQE=(1,992*TTE)-0,4316
      GO TO 132
  126 IF(TTE,GE,0,75) GO TO 128
      X=EXP(TTE)
      Y=(0,533+(2,46*X))
      QQE=ALOG(Y)
      GO TO 132
  128 IF(TTE,GT,1,0) GO TO 130
      X=EXP(TTE)
      Y=(1,6267+(1,0229*X))
      QQE=ALOG(Y)
      GO TO 132
  130 IF(T,LE,TE(N)) GO TO 132
      TA=T-TE(N)
      BETA=(60,0*QE(N)*TA)/VO(N)
      QQE= (((2,0*BETA)+1,0)**(-1,5))
  132 Q(I,K)=(QE(N)*QQE*W(I))
  120 CONTINUE
  152 IF(IZ,NE,0) GO TO 1000
      WRITE(6,64)I,KO,KI(N),VE(N),QE(N),TE(N),VO(N)
      WRITE(6,66) N
      WRITE(6,60) (Q(I,K), K=1,KSTEP)
C     SUM HYDROGRAPHS FOR ALL TIME INCREMENTS
 1000 J=N
      DO 140 K=1,KSTEP
      SUMQ(I,J)=SUMQ(I,J)+Q(I,K)
      J=J+1
C     CONVERT HYDROGRAPH TO UNITS OF INCHES
  138 RUNOFF(I,K)=(SUMQ(I,K)*TI*60.0*12.0)/(WID*XLEN)
C     ADD HYDROGRAPHS FROM ALL CONTRIBUTORY AREAS
      INFLOW(K)=INFLOW(K)+RUNOFF(I,K)
  140 CONTINUE
  110 CONTINUE
      WRITE(6,68) I
      WRITE(6,60) (SUMQ(I,K), K=1,KSTEP)
  100 CONTINUE
      DO 136 K=1,N
  136 INFLOW(K)=INFLOW(K)+RAIN(K)/60,*TI
  200 WRITE(6,70)
      WRITE(6,60) (INFLOW(K),K=1,KSTEP)
      KPT=KP*TI/60,0
      KST=KS*TI/60,0
      KGT=KG*TI/60,0
      KDT=KD*TI/60,0
C     CALCULATION OF LOSSES DUE TO EVAPORATION
```

```
      IF (NEVAP,EQ.30) EVAP=EVAP/30.
      IF (NEVAP,EQ.7) EVAP=EVAP/7.
C     25( INCREASE DUE TO HEAT ABSOBTION BY PAVEMENT
      EVAP=EVAP*1,25
      ER=2,*EVAP/(14,0*60,0)
C*** 760514 ADDITION OF HEADER OUTPUT IN SWMM FORMAT
      WRITE(6,78)TITLE
      DUMMY=0,
      NPOLL=3
      STARTT=3600,*TSTHR+60,*TSTMIN
      NAREA=1
      TAREA=0,
      DO 610 I=1,IAREA
      TAREA=TAREA+W(I)*L(I)
  610 CONTINUE
      DELT=TI*60
      WRITE(NOUT) TITLE
      WRITE(NOUT) KSTEP,NAREA,NPOLL,DELT,STARTT,TAREA
      WRITE(NOUT) IGUTTN
      DO 900 K=1,KSTEP
      T=TI*K
      TCLK=(TSTHR*60,)+TSTMIN+T
      DAYMIN=24,*60,
  208 IF (TCLK,GT,DAYMIN) TCLK=TCLK-DAYMIN
      IF (TCLK,GT,DAYMIN) GO TO 208
      TSTART=6,*60,
      TEND=20,*60,
      IF (TCLK,LE,TSTART,OR,TCLK,GE,TEND) GO TO 205
      TPEAK=14,*60,
      IF (TCLK,GT,TPEAK) GO TO 210
      OEVAP=ER*(TCLK-TSTART)/(8,*60,)
      GO TO 215
  210 OEVAP=ER-(ER*((TCLK-TPEAK)/(6,0*60,)))
      GO TO 215
  205 OEVAP=0,0
  215 INFLOP=INFLOW(K)+SURDEP-(OEVAP*TI)
      IF(INFLOP,LE,0,) INFLOP = 0,
C     COMPUTATION OF INITIAL SURFACE STORAGE
      IF (INFLOP,LE,KPT) GO TO 300
      H1=INFLOP
      E=KPT/(2,3*DP)
      H2=H1/(10,0**E)
      OVERTP=H1-H2
      IF(OVERTP,LE,KPT) OVERTP=KPT
      IF(STORP,GE,STMXP) OVERTP=0,0
      SURDEP=INFLOP-OVERTP
      GO TO 305
  300 OVERTP=INFLOP
      IF(STORP,GE,STMXP) OVERTP=0,0
      SURDEP=INFLOP-OVERTP
C     COMPUTATION OF FLOW THROUGH POROUS PAVEMENT
  305 OVERTP=OVERTP+STORP
      IF (OVERTP,LE,KST) GO TO 400
      H1=OVERTP/PORP*100,0
      E=KST/(2,3*DS)
      H2=H1/(10,0**E)
      OVERTS=(H1-H2)*PORP/100,0
      IF(OVERTS,LE,KST) OVERTS=KST
      IF (ISEAL,EQ,0) GO TO 405
      OHORP=STRCON*OVERTS
      IF(STORS,GE,STMXS) OVERTS=0,0
      GO TO 410
  405 OHORP=0,0
  410 STORP= OVERTP-OVERTS-OHORP
      IF(STORP,LE,0,0)STORP=0,0
      GO TO 415
```

```
C      COMPUTATION OF  FLOW THROUGH SUBGRADE
  400 OVERTS=OVERTP
      IF(STORS,GE,STMXS) OVERTS=0,0
      STORP=OVERTP-OVERTS
  415 OVERTS=OVERTS+STORS
      IF (OVERTS,LE,KGT) GO TO 500
      TK=KGT+KDT
      IF (OVERTS,LE,TK) GO TO 500
      OVERTD=KDT
      OVERTB=OVERTS-OVERTD
      H1=OVERTB/PORS*100.
      E=KGT/(2,3*DG)
      H2=H1/(10,0**E)
      OVERTG=(H1-H2)*PORS/100.
      IF(OVERTG,LE,KGT) OVERTG=KGT
      IF (ISEAL,EQ,0) GO TO 505
      OHORS=STRCON*OVERTG
      IF(STORG,GE,STMXG) OVERTG=0,0
      GO TO 510
  505 OHORS=0,0
  510 STORS=OVERTS-OVERTG-OHORS-OVERTD
      IF(STORS,LE,0,0)STORS=0,0
      GO TO 515
  500 OVERTG=OVERTS
      STORS=OVERTS-OVERTG
      OVERTD=OVERTG-KGT
      OVERTG=KGT
      IF(OVERTD,GT,0,0)GO TO 515
      OVERTD=0.0
      OVERTG=OVERTS
  515 STORG=STORG+OVERTG
      IF(STORG,LE,0.0)STORG=0.0
      IF (STORG,LE,STMXG) GO TO 520
      STORS=STORS+STORG-STMXG
      STORG=STMXG
  520 IF (STORS,LE,STMXS) GO TO 525
      STORP=STORP+STORS-STMXS
      STORS=STMXS
  525 IF (STORP,LE,STMXP) GO TO 530
      SURDEP=SURDEP+STORP-STMXP
      STORP=STMXP
      IF(SURDEP,LE,0,0) GO TO 620
  530 IF (SPAVE,LE,0,0) GO TO 600
      OSURF=1,486*(SURDEP/12,0)**1,667*SPAVE**0.5*DSLEN/XN
      GO TO 605
  600 OSURF=CWEIR*((SURDEP-DEDDEP)/12,0)**1.5*LWEIR
  605 OSURF=12,0*OSURF*TI*60./(WID*XLEN)
      GO TO 615
  620 OSURF=0,0
  615 SURDEP=SURDEP-OSURF
      SURF(K)=OSURF
      DRAIN(K)=OVERTD
      SUM=(OSURF+OVERTD)*WID*XLEN/(12,*DELT)
      TIME=T*60,
C*** 760514 OUTPUT OF INLET HYDROGRAPHS
C*** 760602 COMBINE BLOCK EXPECTS THREE POLLUTANTS, EPA OF EHA
      WRITE(NOUT) TIME,SUM,DUMMY,DUMMY,DUMMY
      WRITE(6,72)       T,INFLOW(K),OEVAP,INFLOP,OSURF,OVERTP,OHORP,
     1OVERTS,OHORS,OVERTG,SURDEP,STORP,STORS,STORG
  900 CONTINUE
      WRITE(6,90)TITLE
      WRITE(6,60)(SURF(K),K=1,KSTEP)
      WRITE(6,92)
      WRITE(6,60)(DRAIN(K),K=1,KSTEP)
   11 FORMAT(10X,20A4)
   50 FORMAT(1H1,25X,///,5X,21HPOROUS PAVEMENT MODEL,///2(10X,20A4/)///)
```

```
52 FORMAT(10X,33HNUMBER OF CONTRIBUTORY SUBAREAS =, 7X,I5,/,
  1        10X,35HNUMBER OF RAINFALL TIME INTERVALS =, 5X,I5,/,
  2        10X,31HNUMBER OF COMPUTATIONAL STEPS =, 9X,I5,/,
  3        10X,33HNUMBER OF RUNOFF TIME INTERVALS =, 7X,I5,/
  4        10X,14HINLET NUMBER =,24X,I5,/////)
54 FORMAT(15X,23HSUBAREA CHARACTERISTICS,//,
  4        10X,7HSUBAREA,8X,9HROUGHNESS,6X,5HSLOPE,9X,6HLENGTH,9X,5HWI
  5DTH,   10X,7H NUMBER,8X,9H  COEFF  ,/)
56 FORMAT(13X,I2,12X,F5.3,8X,F5.3,10X,F6.1,9X,F6.1)
58 FORMAT(10X,///,25X,19HINPUT RAINFALL DATA,//)
60 FORMAT(5X,10F10.6)
61 FORMAT(///,10X,27HCOMPUTATIONAL TIME INTERVAL,F10.3,2X,7HMINUTES)
62 FORMAT(/////,25X,22HINPUT EVAPORATION DATA,//,10X,13HSTARTING TIME
  6,F5.0,2HHR,F5.0,3HMIN,//,10X,21HEVAPORATION DEPTH FOR,I5, 8H DAYS
  7IS,F9.3,7H INCHES,/)
64 FORMAT(1H1,/////,25X,55HIZZARD'S DIMENSIONLESS HYDROGRAPH CONSTANT
  1S FOR SUBAREA,I5,
  1  //,5X,3HK0=,F9.3,4X,3HKI=,F9.3,4X,3HVE=,F9.3,4X,3HQE=,F9.3,4X,3H
  2TE=,F9.3,4X,3HVO=,F9.3,/)
66 FORMAT(////,25X,49HCOMPUTED HYDROGRAPH FOR RAINFALL INCREMENT NUMB
  3ER,I5,9H   IN CFS,//)
68 FORMAT(1H1,/////,25X,68HCUMULATIVE HYDROGRAPH FOR ALL RAINFALL INC
  1REMENTS IN CFS FOR SUBAREA,I5,//)
70 FORMAT(1H1,/////,25X,47HTOTAL INFLOW ONTO THE POROUS PAVEMENT IN I
  5NCHES,//)
72 FORMAT(5X,F6.0,9F8.2,4F9.2)
78 FORMAT(1H1,/////,45X,32HPOROUS PAVEMENT MODELING RESULTS,//
  42(25X,20A4/)//,40X,41HIN UNITS OF INCHES EXCEPT TIME IN MINUTES,//
  5/,7X,4HTIME,2X,6HINFLOW,3X,5HQEVAP,2X,6HINFLOP,3X,5HQSURF,
  62X,6HOVERTP,3X,5HQHORP,2X,6HOVERTS,3X,5HQHORS,2X,6HOVERTG,
  M3X,6HSURDEP,4X,5HSTORP,4X,5HSTORS,4X,5HSTORG,//)
80 FORMAT(1H1,/////,25X,31HPOROUS PAVEMENT CHARACTERISTICS,///,
  135X,5HPERM.,5X,5HDEPTH,4X,6HPOROS-,5X,5HINIT.,6X,4HMAX.,/,
  235X,5HCOEFF,5X,        9X,6H ITY  ,5X,5HSTOR.,5X,5HSTOR.,//,
  310X,8HPAVEMENT,12X,5F10.3,/)
82 FORMAT(10X,8HSUBGRADE,12X,5F10.3,/)
84 FORMAT(10X,14HNATURAL GROUND,6X,5F10.3,/)
85 FORMAT(10X,16HARTIFICIAL DRAIN,4X,2F10.3)
86 FORMAT(/////,15X,19HWIDTH OF PAVEMENT =,26X,F10.3,/,
  1              15X,20HLENGTH OF PAVEMENT =,25X,F10.3,/,
  2              15X,19HSLOPE OF PAVEMENT =,26X,F10.3,/,
  3              15X,35HDOWNSTREAM FLOW WIDTH OF PAVEMENT =,10X,F10.3,
  4            /,15X,34HMANNING COEFFICIENT FOR PAVEMENT =,11X,F10.3,
  5            /,15X,31HWEIR COEFFICIENT FOR PAVEMENT =,14X,F10.3,/,
  6              15X,26HDEAD STORAGE ON PAVEMENT =,19X,F10.3,/,
  7              15X,29HINITIAL STORAGE ON PAVEMENT =,16X,F10.3)
10 FORMAT(10X,6I5)
15 FORMAT(10X,4F10.3)
20 FORMAT(10X,7F10.3)
25 FORMAT(10X,3F10.3)
30 FORMAT(10X,I10,F10.3)
35 FORMAT(10X,11F5.3)
40 FORMAT(10X,6F10.3,2I5)
90 FORMAT(1H1,///2(25X,20A4/)///,32X,36HSURFACE RUNOFF HYDROGRAPH, IN
  1 INCHES,//)
92 FORMAT(/////,29X,44HHYDROGRAPH OF OUTFLOW THRU DRAIN , IN INCHES,
  2//)
   END
```

```
      PROGRAM BASFLO
C
C
C       DETERMINING VOLUME OF FLOW FROM A HYDROGRAPH USING BASEFLOW
C            RECESSION COEFFICIENTS AND GROUNDWATER DISCHARGE
C
C
C     CMVOL  = CUMMULATIVE RECESSION VOLUME IN CUBIC FEET
C     COEFK  = K COEFFICIENT IN RECESSION EQUATION
C     DELT   = INTEGRATION PERIOD IN MINUTES
C     GRND   = INCREMENTAL GROUNDWATER VOLUME IN CUBIC FEET
C     GSLOPK = SLOPE OF GROUNDWATER FLOW
C     IEND   = END OF STORM COUNTER
C     IGRND  = TYPE OF GROUNDWATER RELATIONSHIP
C     IMST   = MULTIPLE STORM COUNTER
C     IST    = INTEGER FOR TIME-STEP INCREMENT
C     KRES   = NUMBER OF KNOWN RECESSION FLOW CONSTANTS
C     NSTEP  = NUMBER OF TIME-STEPS TO BE CALCULATED
C     QBSFL  = RUNOFF HYDROGRAPH WITH NEW RECESSION FLOWS IN CFS
C     QCOEF  = INITIAL GROUNDWATER FLOW IN CFS
C     QGNEW  = CALCULATED GROUNDWATER DISCHARGE IN CFS
C     QLNRES = KNOWN RECESSION LN FLOW VALUES IN CFS
C     QNEWR  = FLOW GENERATED FROM RECESSION EQUATION IN CFS
C     QRES   = STARTING RECESSION FLOW VALUES IN CFS
C     RESC1  = RECESSION FLOW INTERCEPT COEFFICIENT
C     RESC2  = RECESSION FLOW SLOPE COEFFICIENT
C     SLOPE  = INSTANTANEOUS SLOPE OF HYDROGRAPH
C     STVOL  = INCREMENTAL SURFACE RUNOFF IN CUBIC FEET
C     TOTVM  = CUMMULATIVE TOTAL RUNOFF IN CUBIC FEET
C     VOLM   = INCREMENTAL RECESSION VOLUME IN CUBIC FEET
C     WFLOW  = INSTANTANEOUS FLOW FROM WATERSHED IN CFS
C     WLNF   = NATURAL LOG OF RECESSION FLOW
C     IDOUT = ELEMENT NUMBER FOR RUNOFF HYDROGRAPH
C
      COMMON/TAPES/INCNT,IOUTCNT,JIN(10),JOUT(10),NSCRAT(5)
      DIMENSION WFLOW(150),QNEWR(150),VOLM(150),CMVOL(150),GRND(150)
      DIMENSION JN(50),TFLOW(50),QUAL(10,4)
      DIMENSION TOTVM(150),SLOPE(150),STVOL(150),QGNEW(150),QBSFL(150)
      DIMENSION QRES(10),QLNRES(10),RESC1(10),RESC2(10),TITLE(40)
      DATA TOTVM/150*0,/,QNEWR/150*0./,QGNEW/150*0./,VOLM/150*0./
      DATA CMVOL/150*0./,GRND/150*0./,SLOPE/150*0./,QBSFL/150*0./
      DATA N5,N6/5,6/
C****
C**** READ IN KNOWN DATA
C****
C****
      INCNT=INCNT+1
        IOUTCNT=IOUTCNT+1
      NIN=JIN(INCNT)
      NOUT=JOUT(IOUTCNT)
      REWIND NIN
      REWIND NOUT
      READ(NIN)TITLE
      READ(NIN)NSTEP,NOUTS,NPOLL,DT,TZERO,TAREA
      DELT=DT/60,
      READ(NIN) (JN(I),I=1,NOUTS)
      READ(N5,500) IDOUT,KRES.IGRND,GCOEF,GSLOPK
500   FORMAT(3I10,2F10,0)
      READ (N5,510) (QRES(KIKK),QLNRES(KIKK),RESC1(KIKK),RESC2(KIKK),
     1 KIKK=1.KRES)
```

```
510   FORMAT(4F10,0)
      JN(NOUTS+1)=IDOUT
      I=0
501   I=I+1
      IF(JN(I),NE,IDOUT)GO TO 501
      IF(I,GT,NOUTS)GO TO 5000
      IHYD=I
      DO 503 I=1,NSTEP
      READ(NIN)TIMX,(TFLOW(J),J=1,NOUTS)
      WFLOW(I)=TFLOW(IHYD)
503   CONTINUE
C**** CLEAR THE RECESSION ARRAYS
C****
      DO 20 KKK=1,NSTEP
      CMVOL(KKK) = 0,
      GRND (KKK) = 0,
      OBSFL(KKK) = 0,
      QGNEW(KKK) = 0,
      QNEWR(KKK) = 0,
      SLOPE(KKK) = 0,
      STVOL(KKK) = 0,
      TOTVM(KKK) = 0,
      VOLM (KKK) = 0,
 20   CONTINUE
      IEND = 0
      QGNEW(1) = QCOEF
      OBSFL(1) = WFLOW(1)+QGNEW(1)
C****
C**** COMPUTE GROUNDWATER DISCHARGE FUNCTION FLOWS
C****
C**** COMPUTE VOLUME FOR CONSTANT GROUNDWATER FUNCTION
C****                  WHEN IGRND = 0
C****
      IF(IGRND,GT,0) GO TO 40
      DO 30 KHOU=2,NSTEP
      QGNEW(KHOU) = QCOEF
      GRND(KHOU) = QGNEW(KHOU)*DELT*60,
 30   CONTINUE
      GO TO 80
C****
C**** COMPUTE VOLUME FOR STRAIGHT LINE GROUNDWATER FUNCTION
C****                   WHEN IGRND = 1
C****
 40   IF(IGRND,GT,1) GO TO 60
      DO 50 KTRK=2,NSTEP
      QGNEW(KTRK) = QCOEF+(GSLOPK*DELT*(KTRK-1))
      GRND(KTRK) = (QGNEW(KTRK)+QGNEW(KTRK-1))*DELT*60./2,
 50   CONTINUE
      GO TO 80
C****
C**** COMPUTE VOLUME FOR LOGARITHMIC GROUNDWATER FUNCTION
C****                  WHEN IGRND = 2
C****
 60   DO 70 KHTV=2,NSTEP
      QGNEW(KHTV) = QCOEF*EXP(GSLOPK*DELT*(KHTV-1))
      GRND(KHTV) = (QGNEW(KHTV)+QGNEW(KHTV-1))*DELT*60./2,
 70   CONTINUE
C****
C**** SELECT MAXIMUM DISCHARGE FOR STORM AND
C****    COMPUTE TOTAL VOLUME ACCUMULATED
C****
 80   IST = 1
 100  IST = IST+1
      IMST = 0
      ISTM1 = IST-1
      ISTP1 = IST+1
      ISTP2 = IST+2
      IF(IST,GE,NSTEP) IEND=1
      IF(ISTP1,GE,NSTEP) ISTP1=IST
      IF(ISTP2,GE,NSTEP) ISTP2=ISTP1
      IF(WFLOW(ISTM1),GT,WFLOW(IST),AND,WFLOW(IST),GT,WFLOW(ISTP1),AND,
     1  WFLOW(ISTP1),GT,WFLOW(ISTP2)) GO TO 110
      STVOL(IST) = ((WFLOW(ISTM1)-QGNEW(ISTM1))+(WFLOW(IST)-QGNEW(IST)))
     1  *DELT*60,/2,
      TOTVM(IST) = STVOL(IST)+GRND(IST)+TOTVM(ISTM1)
      QBSFL(IST) = WFLOW(IST)+QGNEW(IST)
      IF(IEND,EQ,1) GO TO 200
      GO TO 100
C****
C**** COMPUTE THE SLOPE OF THE RECESSION
C****     AND THE VOLUME ACCUMULATED
C****
 110  SLOPE(IST) = (WFLOW(ISTM1)-WFLOW(IST))/DELT
      SLOPE(ISTP1) = (WFLOW(IST)-WFLOW(ISTP1))/DELT
      IST = IST-1
 120  IST = IST+1
      ISTM1 = IST-1
      ISTP1 = IST+1
      ISTP2 = IST+2
      IF(IST,GE.NSTEP) IEND=1
      IF(ISTP1.GE,NSTEP) ISTP1=IST
      IF(ISTP2.GE,NSTEP) ISTP2=ISTP1
      SLOPE(ISTP2) = (WFLOW(ISTP1)-WFLOW(ISTP2))/DELT
      STVOL(IST) = ((WFLOW(ISTM1)-QGNEW(ISTM1))+(WFLOW(IST)-QGNEW(IST)))
     1  *DELT*60./2,
      TOTVM(IST) = STVOL(IST)+GRND(IST)+TOTVM(ISTM1)
      QBSFL(IST) = WFLOW(IST)+QGNEW(IST)
C****
C**** CHECK THE SLOPE OF THE RECESSION AND
C****     FIND THE POINT OF INFLECTION
C****
      IF(SLOPE(IST).LE.SLOPE(ISTP1).AND.SLOPE(ISTP1).LE.SLOPE(ISTP2))
     1  GO TO 120
      IF(SLOPE(IST).LE.SLOPE(ISTP1).AND.SLOPE(ISTP1).GT.SLOPE(ISTP2))
     1  GO TO 120
      IF(SLOPE(IST).GT,SLOPE(ISTP1).AND.SLOPE(IST),GT.SLOPE(ISTP2))
     1  GO TO 130
      IF(IEND.EQ,1) GO TO 200
      GO TO 120
C****
C**** CHECK IF THE FLOW IS WITHIN THE RECESSION RANGE
C****
 130  WLNF = ALOG(WFLOW(IST))
      IF(WLNF,GT,QLNRES(KRES)) GO TO 120
      QNEWR(IST) = WFLOW(IST)
      QBSFL(IST) = QNEWR(IST)+QGNEW(IST)
 140  IST = IST+1
      ISTM1 = IST-1
      ISTP1 = IST+1
      ISTP2 = IST+2
      IF(IST,GE,NSTEP) IEND=1
      IF(ISTP1,GE,NSTEP) ISTP1=IST
      IF(ISTP2,GE,NSTEP) ISTP2=ISTP1
C****
C**** CHECK FOR ADDITIONAL STORMS
C****
      IF(WFLOW(IST),LT,WFLOW(ISTP1),AND,WFLOW(ISTP1),LT,WFLOW(ISTP2))
     1  IMST = 1
C****
C**** SELECT RECESSION CONSTANTS
C****
      WLNF = ALOG(QNEWR(ISTM1))
      DO 150 KLOL=1,KRES
      IF(WLNF.LE.QLNRES(KLOL)) GO TO 160
 150  CONTINUE
C****
C**** COMPUTE RECESSION DISCHARGE
C****
 160  COEFK = RESC1(KLOL)+(RESC2(KLOL)*WLNF)
      QNEWR(IST) = QNEWR(ISTM1)*EXP((-1.)*COEFK*DELT/720.)
C****
C**** COMPUTE RECESSION FLOW VOLUME
C****
      IF(QNEWR(IST).GT.GGNEW(IST)) GO TO 170
      IF(QNEWR(IST).LT.QGNEW(IST)) QNEWR(IST)=QGNEW(IST)
      IF(QNEWR(ISTM1).LT.QGNEW(ISTM1)) ONEWR(ISTM1)=QGNEW(ISTM1)
      IEND = 1
 170  QBSFL(IST) = GNEWR(IST)+QGNEW(IST)
      VOLM(IST) = ((QNEWR(ISTM1)-QGNEW(ISTM1))+(QNEWR(IST)-QGNEW(IST)))
     1  *DELT*60./2.
      CMVOL(IST) = VOLM(IST)+CMVOL(ISTM1)
      TOTVM(IST) = VOLM(IST)+GRND(IST)+TOTVM(ISTM1)
      IF(IEND.EQ.1) GO TO 200
      IF(IMST.EQ.1) GO TO 100
      GO TO 140
C****
C**** PRINT OUT DATA
C****
 200  WRITE (N6,600) TITLE,NSTEP,DELT
 600  FORMAT (1H1//2(20X20A4/),///,2X,30HMAXIMUM NUMBER OF TIME-STEPS =,
     1  20X,I5,//,2X,20HINTEGRATION PERIOD =,25X,F10.2,1X,7HMINUTES,/)
      WRITE(N6,601)IDOUT
601   FORMAT(1H ,1X,39HBASFFLOW HYDROGRAPH FROM ELEMENT NUMBER,1X,I5)
      IF(IGRND.GT.0) GO TO 210
      WRITE (N6,610) QCOEF
 610  FORMAT (1H ,1X,37HCONSTANT GROUNDWATER FUNCTION VALUE =,8X,
     1  F10.2,1X,3HCFS,/)
      GO TO 230
 210  IF(IGRND.GT.1) GO TO 220
      WRITE (N6,620) QCOEF,GSLOPK
 620  FORMAT (1H ,1X,44HINITIAL STRAIGHT LINE GROUNDWATER FUNCTION =,
     1  1X,F10.2,1X,3HCFS,//,1X,33HSTRAIGHT LINE GROUNDWATER SLOPE =,
     2  12X,F10.6,/)
      GO TO 230
 220  WRITE (N6,630) QCOEF,GSLOPK
 630  FORMAT (1H ,1X,42HINITIAL LOGARITHMIC GROUNDWATER FUNCTION =,2X,
     1  F10.2,1X,3HCFS,//,1X,31HLOGARITHMIC GROUNDWATER SLOPE =,10X,
     2  F10.6,/)
 230  WRITE (N6,640)
 640  FORMAT (1H ,////,T22,14HRECESSION DATA,//,T5,8HSTARTING,
     1  T18,11HNATURAL LOG,T34,9HRECESSION,T50,9HRECESSION,/,T2,
     2  14HRECESSION FLOW,T20,7HOF FLOW,T34,9HINTERCEPT,T52,5HSLOPE,/,
     3  T7,3HCFS,T22,3HCFS,T33,11HCOEFFICIENT,T49,11HCOEFFICIENT,/)
      WRITE (N6,650) (QRES(JJJ),QLNRES(JJJ),RESC1(JJJ),RESC2(JJJ),
     1  JJJ=1,KRES)
 650  FORMAT (1H ,F10.2,3F15.4)
      WRITE (N6,655) TITLE
 655  FORMAT (1H1,//,2(20X,20A4/))
      WRITE (N6,660)
 660  FORMAT (1H ,//,T5,7HSURFACE,T16,6HGROUND,T25,9HRECESSION,T40,
     1  6HGROUND,T55,7HSURFACE,T68,9HRECESSION,T82,10HCUMULATIVE,T97,
     2  10HCUMULATIVE,T117,5HTOTAL,/,T5,6HRUNOFF,T16,5HWATER,T28,4HFLOW,
     3  T40,5HWATER,T55,6HRUNOFF,T70,6HRUNOFF,T82,9HRECESSION,T96,
     4  12HSTORM RUNOFF,T114,10HHYDROGRAPH,/,T7,3HCFS,T17,3HCFS,
     5  T28,3HCFS,T40,5HCU FT,T55,5HCU FT,T70,5HCU FT,T85,5HCU FT,T99,
     6  5HCU FT,T118,3HCFS,/)
      WRITE (N6,670) (WFLOW(LLL),QGNEW(LLL),QNEWR(LLL),GRND(LLL),
     1  STVOL(LLL),VOLM(LLL),CMVOL(LLL),TOTVM(LLL),QBSFL(LLL),LLL=1,IST)
 670  FORMAT(1H ,3F10.2,6F15.2)
      REWIND NIN
      READ(NIN)TITLE
      READ(NIN)NSTEP,NOUTS,NPOLL,DT,TZERO,TAREA
      READ(NIN)(JN(I),I=1,NOUTS)
      WRITE(NOUT)TITLE
      WRITE(NOUT)NSTEP,NOUTS,NPOLL,DT,TZERO,TAREA
      WRITE(NOUT)(JN(I),I=1,NOUTS)
      DO 504 I=1,NSTEP
      READ(NIN) TIMX,(TFLOW(J),J=1,NOUTS),((QUAL(J,K),K=1,NPOLL)
     1 ,J=1,NOUTS)
      TFLOW(IHYD)=QBSFL(I)
      WRITE(NOUT) TIMX,(TFLOW(J),J=1,NOUTS),((QUAL(J,K),K=1,NPOLL)
     1,J=1,NOUTS)
504   CONTINUE
      GO TO 5001
5000  WRITE(N6,602)IDOUT
602   FORMAT(1X,29H*****HYDROGRAPH ID NOT FOUND=,I5)
5001  CONTINUE
      END
      PROGRAM CSTANAL
      DIMENSION DCONV(160),DNAT(160),TAREA(160),AROW(160),XROW(160),XCLR
     1(160),ENR(160),PENR(160),TNAT(160),TCONV(160),SUBN(160),CRAT(160)
C     READ THE NUMBER OF AREAS FOR WHICH COST ESTIMATES ARE TO BE MADE.
      READ(5,10)N
C     READ REQUIRED DATA AND COMPUTE FOR EACH AREA
      DO 65 I=1,N
      READ(5,20)SUBN(I),DCONV(I),DNAT(I),TAREA(I),AROW(I),XROW(I),XCLR(I
     1),ENR(I),PENR(I)
C
      IF(DCONV(I).NE.0.)GO TO 25
C     USE DEFAULT VALUES FOR CONV. AND NAT. DRAINAGH SYSTEMS
      DCONV(I)=1700.
      DNAT(I)=300.
      GO TO 35
   25 IF(DNAT(I).NE.0.)GO TO 35
C     ESTIMATING COST PER ACRE OF NATURAL SYSTEM FROM KNOWN CONV. SYSTEM
C     DATA.USING DEFAULT RATIO OF 0.176.
      DNAT(I)=DCONV(I)*0.176
C     ARE COST INDEX ADJUSTMENTS REQUIRED.IF SO ENR AND PENR ARE NOT
C     EOUAL TO ZERO.
   35 IF(ENR(I).EQ.0..AND.PENR(I).EQ.0.)GO TO 45
C     COMPUTING COST INDEX ADJUSTMENT FACTOR.
      AENR=PENR(I)/ENR(I)
      GO TO 55
C     IF AENR IS NOT REQUIRED OR UNKNOWN DEFAULT VALUE OF 1.0 IS USED.
   45 AENR=1.0
C     ADJUSTING INPUTED COST DATA USING COMPUTED AENR.
   55 DCONV1=CCONV(I)*AENR
      DNAT1=DNAT(I)*AENR
C     COMPUTATIONS FOR R.O.W. AND CLEARING COSTS FOR NATURAL SYSTEM.
      RWCL=AROW(I)*(XROW(I)+XCLR(I))
C     COMPUTE TOTAL NATURAL AND CONVENTIONAL DRAINAGE COSTS.
      TNAT(I)=RWCL+(TAREA(I)*DNAT1)
      TCONV(I)=TAREA(I)*DCONV1
   65 CRAT(I)=TNAT(I)/TCONV(I)
      CONV=0.0
      XNAT=0.0
      AREA=0.0
      ROW=0.0
      DO 95 I=1,N
      CONV=TCONV(I)+CONV
      XNAT=TNAT(I)+XNAT
      AREA=TAREA(I)+AREA
   95 ROW=AROW(I)+ROW
      RAT=XNAT/CONV
      WRITE(6,30)
      DO 75 I=1,N
   75 WRITE(6,40)SUBN(I),DCONV(I),DNAT(I),XROW(I),XCLR(I),TAREA(I),AROW(
     1I),ENR(I),PENR(I),TCONV(I),TNAT(I),CRAT(I)
      WRITE(6,50)AREA,ROW,CONV,XNAT,RAT
C     FORMAT STATEMENTS.
   10 FORMAT(I3)
   20 FORMAT(I3,8F9.2)
   30 FORMAT(1H1,41X,10HCOMPARISON,1X,2HOF,1X,4HCOST,1X,7HBETWEEN,1X,7HN
     1ATURAL,1X,3HAND,1X,12HCONVENTIONAL,/,47X,8HDRAINAGE,1X,7HSYSTEMS,1
     2X,3HFOR,1X,4HEACH,1X,12HSUBCATCHMENT,//,27X,12HCOST ($/AC.),23X,10
     3HAREA (AC.),7X,17HE.N.R. COST INDEX,10X,8HCOST ($),8X,10HCOST RATI
     40,/,1X,9HSUBCATCH.,4X,5HCONV.,7X,4HNAT.,72X,5HCONV.,6X,4HNAT.,/,2X
     5,6HNUMBER,6X,5HSYST.,6X,5HSYST.,5X,6HR.O.W.,4X,8HCLEARING,3X,9HSUB
     6CATCH,,3X,6HR,O,W,,6X,4HPAST,6X,7HPRESENT,5X,5HSYST,,6X,5HSYST,,4X
     7,10HNAT,/CONV,,//)
   40 FORMAT(1H0,1X,I3,4X,8F11.2,2F11.0,F11.2)
   50 FORMAT(1H0,1X,8HTOTAL    ,43X,2F11.2,22X,2F11.0,F11.2)
      STOP
      END
         MNTVQXE,   07/02/76, *UNITED COMPUTING* 62, APEX/SL 8.5.0


15,17,03$JOB,CM100,T20,
15,17,03$FL       64      0.000
15,17,05$AC2200E829002,0036       ,A
15,17,05, 07/02/76,MNTVQXE
15,17,06$FL     3392      0,002        4         3,
15,17,06$FI       5          1
15,17,06,GET(SWMM3,PORPAV,BASFLO,CSTANAL)
15,17,06,READY -    SWMM3
15,17,07,READY -    PORPAV
15,17,07,READY -    BASFLO
15,17,08,READY -    CSTANAL
15,17,08,COPYSBF(SWMM3,OUTPUT)
15,17,09,END OF INFORMATION ENCOUNTERED.
15,17,09,COPY COMPLETE.
15,17,09,COPYSBF(PORPAV,OUTPUT)
15,17,10,END OF INFORMATION ENCOUNTERED.
15,17,10,COPY COMPLETE.
15,17,10,COPYSBF(BASFLO,OUTPUT)
15,17,10,END OF INFORMATION ENCOUNTERED.
15,17,10,COPY COMPLETE.
15,17,11,COPYSBF(CSTANAL,OUTPUT)
15,17,11,END OF INFORMATION ENCOUNTERED.
15,17,11,COPY COMPLETE.
15,17,11$JT00  4096      0,663      112        18,
15,17,11$FI       60         4
15,17,11,    *FL*  *CPU SEC, *DISC PRUS* DISC ACC
15,17,11,*P.F. PRUS*P.F. ACC *TAPE PRUS* TAPE ACC
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      PROGRAM     XYPLOT                                  CDC 6600 FTN V3.0-P336 OPT=2  09/14/75. 17.27.31.      PAGE      1

                  PROGRAM XYPLOT(INPUT,OUTPUT,TAPE5=INPUT,TAPE6=OUTPUT)
                  COMMON /INOUT/ N5,N6
                  COMMON /GRAPH/ IGRAPH(6)
            C     PURPOSE
            C       PREPARE DATA FOR A SINGLE CURVE
            C
            C     DESCRIPTION OF PARAMETERS
            C       T      - TIME IN MINUTES
            C       Q      - DISCHARGE IN CFS
            C       C      - CONCENTRATIONS IN MG/L   Y VALUES TO BE PLOTTED
            C       K      - NUMBER OF TIME PERIODS
            C       KK     - NUMBER OF CONCENTRATION RUNS
            C       PNDS   - POUNDS OF CONCENTRATIONS IN A GIVEN TIME PERIOD
            C       SUM    - TOTAL NUMBER OF POUNDS OF CONCENTRATION
            C       X      - ACCUMULATED TIME IN MINUTES  X VALUES TO BE PLOTTED
            C       KDATA  - 0 FOR NORMAL DATA(RICE)   1 FOR TEXAS TECH DATA
            C
            C       IGRAPH  IS A PLOT CONTROL VARIABLE
            C              ENTER A 0  FOR NO GRAPH  OR A 1  FOR GRAPH
            C        KEY FOR VARIABLE IGRAPH FOLLOWS
            C       IGRAPH(1)  MG/L  VS  TIME
            C       IGRAPH(2)  POUNDS  VS  TIME
            C       IGRAPH(3)  POUNDS  VS. CUBIC FEET
            C       IGRAPH(4)  MG/L  VS  MG/L
            C       IGRAPH(5)  POUNDS  VS  POUNDS
            C       IGRAPH(6)  MASS FLOW RATE VS TIME
            C
            C
            C
                  DIMENSION T(100),Q(100),C(100),TITLE(20),LABX(40),LABY(40),X(100)
                  DIMENSION QDELT(100),PNDS(100)
                  DIMENSION XCC(100),LABXC(40)
                  DIMENSION PNDX(100),PNDMIN(100)
                  DATA ENDA/4HENDA/
                  N5=5
                  N6=6
            C**** READ AND PRINT OUT A TITLE
                5 READ (N5,110) TITLE
                  IF(TITLE(1).EQ.ENDA) GO TO 5000
                  WRITE(N6,105) TITLE
              105 FORMAT(1H1,20X,20A4,/)
            C**** READ AND WRITE CONTROL CARD
                  READ (N5,120) K,KK,ILAB,KDATA,IGRAPH
                  WRITE (N6,121) K,KK,ILAB,KDATA,IGRAPH
            C**** INITIALIZE VARIABLES
            C****   THESE CARDS ONLY FOR ANNUAL REPORT GRAPHS      **********
                  LX = 97
                  LY =43
            C***************************************************
                  LX=111
                  LY=50
                  KM1 = K-1
            C**** READ AND WRITE TIME INTERVALS
                  READ (N5,100) (T(I),I=1,K)
                  WRITE(N6,102)
              102 FORMAT(1H0,10X,25HTIME INTERVALS IN MINUTES ,/)
      WRITE (N6,101) (T(I),I=1,K)
C**** FIND MIN AND MAX VALUES FOR TIME
      XMIN=T(1)
      XMAX=T(1)
      DO 10 I=2,K
      XMAX=T(I)+XMAX
   10 X(I)=XMAX
C****    WRITE OUT CUMULATIVE TIME VALUES
      WRITE(N6,153)
  153 FORMAT(1H0,10X,32HCUMULATIVE TIME AT EACH INTERVAL ,/)
      WRITE(N6,101) (X(I),I=1,K)
      XDEL=(XMAX-XMIN)/10.0
C**** THESE CARDS FOR ANNUAL REPORT GRAPHS   *******
C     XMIN = 0.0
C     XMAX = 5760.
C     XDEL = 720.
C*****************************************************
C**** READ AND WRITE DISCHARGE VALUES
      IF(KDATA.EQ.1)
     *READ (N5,100) (Q(I),I=1,KM1)
      IF(KDATA.EQ.1)   Q(K) = Q(KM1)
      IF(KDATA.NE.1)
     *READ (N5,100) (Q(I),I=1,K)
      WRITE(N6,103)
  103 FORMAT(1H0,10X,44HDISCHARGE RATES AT EACH TIME INTERVAL IN CFS ,/)
      IF(KDATA.EQ.1) WRITE(N6,113)
  113 FORMAT(1H ,10X,54H ** THESE VALUES ARE AVERAGES OVER THE TIME INTE
     1RVALS       ,/)
      WRITE (N6,101) (Q(I),I=1,K)
C****    PLOT HYDROGRAPH FOR STORM
      IF(KDATA.NE.1)
     *CALL HYGRAF(X,Q,K,XMIN,XMAX,XDEL,LX,YMIN,YMAX,YDEL,LY,LABX,LABY,
     1     ILAB,QDELT,QSUM,T,TITLE)
      IF(KDATA.EQ.1)
     *CALL TECHIN(X,Q,K,XMIN,XMAX,XDEL,LX,YMIN,YMAX,YDEL,LY,LABX,LABY,
     1     ILAB,QDELT,QSUM,T,TITLE)
C**** SET UP A LOOP FOR EACH CONCENTRATION
      DO 20 J=1,KK
C**** CHECK FOR X AND Y AXIS LABELS
      IF(ILAB.EQ.0) GO TO 30
C**** ILAB = 1 SO READ IN X AND Y TITLES
      READ (N5,130) LABX
      READ (N5,130) LABY
C**** READ AND WRITE CONCENTRATION VALUES
   30 READ (N5,100) (C(JJ),JJ=1,K)
      WRITE(N6,105) TITLE
      WRITE(N6,115) LABY
  115 FORMAT(1H0,30X,40A1)
      WRITE(N6,104)
  104 FORMAT(1H0,10X,49HPOLLUTANT CONCENTRATIONS AT EACH INTERVAL IN MG/
     1L ,/)
      WRITE (N6,101) (C(JJ),JJ=1,K)
C**** FIND MIN AND MAX CONCENTRATION VALUES
      IF(J.NE.1) GO TO 38
      DO 35 JJ = 1,K
      PROGRAM    XYPLOT                         CDC 6600 FTN V3.0-P336 OPT=2  09/10/75. 17.27.31.      PAGE     3
         35   XCC(JJ) = C(JJ)
              DO 36 JJ = 1,40
         36   LABXC(JJ) = LABY(JJ)
         38   YMIN=C(1)
              YMAX=C(1)
        C****   THESE CARDS ONLY FOR ANNUAL REPORT GRAPHS      **********
        C     READ(N5,135) YMAX
        135   FORMAT(F10.0)
        C**********************************************
              DO 40 JJ=2,K
              IF(C(JJ).LT.YMIN) YMIN=C(JJ)
              IF(C(JJ).GT.YMAX) YMAX=C(JJ)
           40 CONTINUE
        C**** FIND YDEL
              YDEL=((YMAX-YMIN)/5.0)
        C**** THESE CARDS FOR ANNUAL REPORT GRAPHS    *******
        C     YMIN = 0.0
        C     YDEL=((YMAX-YMIN)/7.0)
        C************************************************
        C**** CALCULATE POUNDS OF CONCENTRATION
              SUM=0.
              PNDS(1)=0.0
              PNDMIN(1) = 0.0
              DO 50 I=2,K
              IF(KDATA.NE.1)
             1PNDS(I)=T(I)*60.*((Q(I-1)+Q(I))/2.0)*((C(I-1)+C(I))/2.0)*6.24E-5
              IF(KDATA.EQ.1)PNDS(I)=T(I)*60.*Q(I-1)*((C(I-1)+C(I))/2.)*6.24E-5
              PNDMIN(I) = PNDS(I)/T(I)
         50   CONTINUE
        C****    WRITE POUNDS OF POLLUTANT DURING EACH TIME INTERVAL AND
        C****    MASS FLOW RATES DURING EACH INTERVAL
              WRITE(N6,125)
        125   FORMAT(1H0,10X,45HPOUNDS OF POLLUTANT DURING EACH TIME INTERVAL,/)
              WRITE(N6,101) (PNDS(I),I=1,K)
              WRITE(N6,145)
        145   FORMAT(1H0,10X,67HMASS FLOW RATE OF POLLUTANT DURING EACH TIME INT
             1ERVAL IN LBS/MINUTE ,/)
              WRITE(N6,101) (PNDMIN(I),I=1,K)
        C
              DO 65 I=2,K
              SUM=PNDS(I) + SUM
         65   PNDS(I)=SUM
              IF(J.NE.1) GO TO 75
              DO 70 I = 1,K
         70   PNDX(I) = PNDS(I)
        C**** WRITE POUNDS OF POLLUTANT AFTER EACH INTERVAL
         75   WRITE(N6,106)
        106   FORMAT(1H0,10X,45HTOTAL POUNDS OF POLLUTANT AFTER EACH INTERVAL,/)
              WRITE(N6,101) (PNDS(I),I=1,K)
        C**** WRITE TOTAL POUNDS
              WRITE (N6,140) SUM
         140 FORMAT (1H0,15X,27HTOTAL POUNDS OF POLLUTANT =,F12.2)
        C**** CALL X-Y PLOT SUBROUTINE
              IF(IGRAPH(1).NE.1)GO TO 80
              WRITE(N6,105) TITLE
```

```
            PROGRAM      XYPLOT                                        CDC 6600 FTN V3.0-P336 OPT=2  09/10/75. 17.27.31.       PAGE      4

                                 CALL PLTR(X,C,K,XMIN,XMAX,XDEL,LX,YMIN,YMAX,YDEL,LY,LABX,LABY,
                                1ILAB)
                          C      WRITE(N6,105) TITLE
                                 CALL FUNPLT (Q,C   ,K,LX,LY,LABX,LABY,ILAB)
        170               C**** PLOT POUNDS VERSUS TIME FOR SAME POLLUTANT
                           80    CONTINUE
                                 IF(IGRAPH(2).NE.1) GO TO 85
                                 WRITE(N6,105) TITLE
                                 CALL      LBTIME(X,PNDS,K,XMIN,XMAX,XDEL,LX,YMIN,YMAX,YDEL,LY,
        175                     1      LABX,LABY,ILAB)
                           85    CONTINUE
                          C**** PLOT  POUNDS VERSUS QUANTITY
                                 CALL       LBQ(QDELT,PNDS,K,LX,LY,TITLE)
                                 IF(J.EQ.1) GO TO 205
        180                      IF(IGRAPH(4).NE.1) GO TO 90
                                 WRITE(N6,105) TITLE
                                 CALL SSXCY(XCC,C,K,LX,LY,LABXC,LABY,ILAB)
                           90    CONTINUE
                                 IF(IGRAPH(5).NE.1) GO TO 205
        185                      WRITE(N6,105) TITLE
                                 CALL LBVSLB (PNDX,PNDS,K,LX,LY,LABXC,LABY,ILAB)
                          205    CONTINUE
                                 IF(IGRAPH(6).NE.1) GO TO 200
                          C****     PLOT MASS FLOW RATE VS TIME
        190                      WRITE(N6,105) TITLE
                                 CALL MASFLO(X,PNDMIN,K,XMIN,XMAX,XDEL,LX,LY,LABX,LABY,ILAB)
                          200    CONTINUE
                           20    CONTINUE
                                 GO TO 5
        195                 100 FORMAT (10F8.2)
                            110 FORMAT (20A8)
                           120   FORMAT(15(2X,I3))
                            130 FORMAT (40A1)
                           121   FORMAT(1X,10I5)
        200                101   FORMAT(10(1X,10F12.2,/))
                          5000 STOP
                                 END

      REGISTER ALLOCATION
         1 REGISTERS ASSIGNED OVER THE LOOP BEGINNING AT LINE     60
         1 REGISTERS ASSIGNED OVER THE LOOP BEGINNING AT LINE    150
         SUBROUTINE  HYGRAF                          CDC 6600 FTN V3.0-P336 OPT=2  09/14/75. 17.27.31.      PAGE      1

                        SUBROUTINE HYGRAF(X,Q,K,XMIN,XMAX,XDEL,LX,YMIN,YMAX,YDEL,LY,LABX,
                       1   LABY,ILAB,QDELT,QSUM,T,TITLE)
                        COMMON /INOUT/ N5,N6
                        DIMENSION X(100),Q(100),LABX(40),QDELT(100),T(100),LABY(40),
     5                 1  LABX1(40),LABY1(40),TITLE(20),QCUM(100)
                        DATA LABX1/10*1H ,1HT,1HI,1HM,1HE,1H ,1H(,1HM,1HI,1HN,1H),20*1H /
                        DATA LABY1/10*1H ,1HQ,1H ,1H ,1HC,1HF,1HS,24*1H /
                        DO 20 J = 1,40
                        LABX(J) = LABX1(J)
    10               20 LABY(J) = LABY1(J)
                        ILABTM = ILAB
                        ILAB =1
                        YMIN = Q(1)
                        YMAX = Q(1)
    15                  DO 40 JJ=2,K
                        IF(Q(JJ).LT.YMIN) YMIN = Q(JJ)
                        IF(Q(JJ).GT.YMAX) YMAX = Q(JJ)
                     40 CONTINUE
                        YDEL = ((YMAX-YMIN)/5.0)
    20                  QSUM = 0.0
                        QDELT(1)=0.0
                        DO 50 I=2,K
                        QDELT(I)=((Q(I-1)+Q(I))/2.0)*T(I)*60.0
                     50 QSUM = QSUM + QDELT(I)
    25                  ACREFT = QSUM/43560.
                        WRITE(N6,110) QSUM,ACREFT
                    110 FORMAT(1H0,10X,14HTOTAL RUNOFF =,F12.0,2X,10HCUBIC FEET,15X,
                       1   F12.2,2X,9HACRE-FEET ,/)
                        WRITE(N6,115) (QDELT(I), I= 1,K)
    30              115 FORMAT(1H ,10X,44HRUNOFF FOR EACH TIME INCREMENT IN CUBIC FEET ,
                       1  //,10(1X,10F12.0,/))
                  C****    CALCULATE AND PRINT CUMULATIVE RUNOFF
                        QTOT = 0.0
                        DO 75 I=1,K
    35                  QTOT = QTOT + QDELT(I)
                     75 QCUM(I)=QTOT
                        WRITE(N6,150) (QCUM(I),I=1,K)
                    150 FORMAT(1H0,10X,55HCUMULATIVE RUNOFF FOR EACH TIME INCREMENT IN CUB
                       1IC FEET ,//,10(1X,10F12.0,/))
    40                  WRITE(N6,105) TITLE
                    105 FORMAT(1H1,20X,20A4,/)
                        CALL PLTR(X,Q,K,XMIN,XMAX,XDEL,LX,YMIN,YMAX,YDEL,LY,LABX,LABY,
                       1    ILAB)
                        ILAB = ILABTM
    45                  RETURN
                        END

   REGISTER ALLOCATION
     1 REGISTERS ASSIGNED OVER THE LOOP BEGINNING AT LINE    34
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        SUBROUTINE  TECHIN              CDC 6600 FTN V3.0-P336 OPT=2  09/14/75. 17.27.31.      PAGE     1

                     SUBROUTINE TECHIN(X,Q,K,XMIN,XMAX,XDEL,LX,YMIN,YMAX,YDEL,LY,LABX,
                    1   LABY,ILAB,QDELT,QSUM,T,TITLE)
                     COMMON /INOUT/ N5,N6
                     DIMENSION X(100),Q(100),LABX(40),QDELT(100),T(100),LABY(40)
          5          DIMENSION XX(100),QQ(100),
                    1  LABX1(40),LABY1(40),TITLE(20)
                     DATA LABX1/10*1H ,1HT,1HI,1HM,1HE,1H ,1H(,1HM,1HI,1HN,1H),20*1H /
                     DATA LABY1/10*1H ,1HQ,1H ,1H ,1HC,1HF,1HS,24*1H /
                     DO 20 J = 1,40
         10          LABX(J) = LABX1(J)
                  20 LABY(J) = LABY1(J)
                     ILABTM = ILAB
                     ILAB =1
                     YMIN = Q(1)
         15          YMAX = Q(1)
                     DO 40 JJ=2,K
                     IF(Q(JJ).LT.YMIN) YMIN = Q(JJ)
                     IF(Q(JJ).GT.YMAX) YMAX = Q(JJ)
                  40 CONTINUE
         20          YDEL = ((YMAX-YMIN)/5.0)
                     QSUM = 0.0
                     QDELT(1)=0.0
                     KK = K*2
                     J=0
         25          DO 25 I=1,KK,2
                     J=J+1
                     XX(I) = X(J)
                  25  XX(I+1) = X(J)
                     DO 30 I = 1,KK,2
         30          QQ(I+1)=QQ(I)
                  30 XX(I+1) = XX(I)
                     QDELT(1) = 0.0
                     QSUM = 0.0
                     DO 60 I = 2,K
         35          QDELT(I) = Q(I-1)*T(I)*60.
                  60 QSUM = QSUM + QDELT(I)
                     WRITE(N6,110) QSUM
                 110 FORMAT(1H0,10X,14HTOTAL RUNOFF =,F12.0,2X,10HCUBIC FEET,/)
                     WRITE(N6,115) (QDELT(I), I= 1,K)
         40      115 FORMAT(1H ,10X,44HRUNOFF FOR EACH TIME INCREMENT IN CUBIC FEET ,
                    1  //,10(1X,10F12.0,/))
                     WRITE(N6,105) TITLE
                 105 FORMAT(1H1,20X,20A4,/)
                     CALL PLTR(XX,QQ,KK,XMIN,XMAX,XDEL,LX,YMIN,YMAX,YDEL,LY,LABX,LABY,
         45         1    ILAB)
                     ILAB = ILABTM
                     RETURN
                     END

    REGISTER ALLOCATION
      1 REGISTERS ASSIGNED OVER THE LOOP BEGINNING AT LINE     25
      1 REGISTERS ASSIGNED OVER THE LOOP BEGINNING AT LINE     34
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       SUBROUTINE  LBTIME                                  CDC 6600 FTN V3.0-P336 OPT=2  09/10/75. 17.27.31.       PAGE     1

                         SUBROUTINE LBTIME(X,PNDS,K,XMIN,XMAX,XDEL,LX,YMIN,YMAX,YDEL,LY,
                       1     LABX,LABY,ILAB)
                         COMMON /INOUT/ N5,N6
                         DIMENSION X(100),PNDS(100),LABX(40),LABY(40),LABY1(6)
         5               DATA LABY1/1HP,1HO,1HU,1HN,1HD,1HS/
                         DO 20 JJ =35,40
                      20 LABY(JJ)= LABY1(JJ-34)
                         YMIN = PNDS(1)
                         YMAX = PNDS(1)
        10               DO 40 JJ = 2,K
                         IF(PNDS(JJ).LT.YMIN) YMIN = PNDS(JJ)
                         IF(PNDS(JJ).GT.YMAX) YMAX = PNDS(JJ)
                      40 CONTINUE
                         YDEL = (YMAX-YMIN)/5.0
        15               CALL PLTR(X,PNDS,K,XMIN,XMAX,XDEL,LX,YMIN,YMAX,YDEL,LY,LABX,LABY,
                       1     ILAB)
                         DO 60 JJ = 35,40
                      60 LABY(JJ)=1H
                         RETURN
        20               END

    REGISTER ALLOCATION
      1 REGISTERS ASSIGNED OVER THE LOOP BEGINNING AT LINE     17
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          SUBROUTINE  LBQ                                   CDC 6600 FTN V3.0-P336 OPT=2  09/14/75. 17.27.31.       PAGE      1

                           SUBROUTINE LBQ(QDELT,PNDS,K,LX,LY,TITLE)
                           COMMON /INOUT/ N5,N6
                           COMMON /GRAPH/ IGRAPH(5)
                           DIMENSION QDELT(100),PNDS(100),LABX(40),LABY(40),LABX1(8),
     5                   1     LABY1(8),X(100),TITLE(20)
                           DATA LABX1/1HC,1HU,1HB,1HI,1HC,1H ,1HF,1HT/
                           DATA LABY1/1HP,1HO,1HU,1HN,1HD,1HS,1H ,1H /
                           ILAB =1
                           DO 19 J =1,40
    10                     LABX(J)= 1H
                       19  LABY(J)= 1H
                           DO 20 J= 33,40
                           LABX(J) = LABX1(J-32)
                       20  LABY(J) = LABY1(J-32)
    15                     X(1) = QDELT(1)
                           XMIN = QDELT(1)
                           XMAX = QDELT(1)
                           YMIN = PNDS(1)
                           YMAX = PNDS(1)
    20                     DO 40 J = 2,K
                           IF(QDELT(J).LT.XMIN) XMIN = QDELT(J)
                           IF(PNDS(J).LT.YMIN) YMIN = PNDS(J)
                           IF(PNDS(J).GT.YMAX) YMAX = PNDS(J)
                           XMAX = QDELT(J) + XMAX
    25                 40  X(J) = XMAX
                           XDEL = (XMAX -XMIN)/10.0
                           YDEL = (YMAX-YMIN)/5.0
                           IF(IGRAPH(3).NE.1) GO TO 50
                           WRITE(N6,105) TITLE
    30                     CALL PLTR(X,PNDS,K,XMIN,XMAX,XDEL,LX,YMIN,YMAX,YDEL,LY,LABX,LABY,
                         1     ILAB)
                       50  CONTINUE
                           CALL SLOPE (X,PNDS,K)
                      105  FORMAT(1H1,20X,20A4,/)
    35                     RETURN
                           END
      REGISTER ALLOCATION
        1 REGISTERS ASSIGNED OVER THE LOOP BEGINNING AT LINE      9
        SUBROUTINE  MASFLO                          CDC 6600 FTN V3.0-P336 OPT=2  09/19/75. 17.27.31.       PAGE      1

                        SUBROUTINE MASFLO(X,PNDMIN,K,XMIN,XMAX,XDEL,LX,LY,LABX,LABY,ILAB)
                  C*****
                  C*****   THIS SUBROUTINE IS SUPPOSED TO PLOT THE MASS FLOW RATE OF A
                  C*****   POLLUTANT IN POUNDS PER MINUTE
         5        C*****
                        DIMENSION X(100),PNDMIN(100),LABX(40),LABY(40),LABY1(11)
                        DATA LABY1/1HL,1HB,1HS,1H ,1HP,1HE,1HR,1H ,1HM,1HI,1HN/
                        DO 20 JJ = 30,40
                   20   LABY(JJ) = LABY1(JJ-29)
        10              YMIN = PNDMIN(1)
                        YMAX = PNDMIN(1)
                        DO 40  JJ=2,K
                        IF(PNDMIN(JJ).LT.YMIN) YMIN = PNDMIN(JJ)
                        IF(PNDMIN(JJ).GT.YMAX) YMAX = PNDMIN(JJ)
        15         40   CONTINUE
                        YDEL = (YMAX - YMIN) / 5.0
                        CALL PLTH(X,PNDMIN,K,XMIN,XMAX,XDEL,LX,YMIN,YMAX,YDEL,LY,LABX,
                       1         LABY,ILAB)
                        DO 60 JJ = 30,40
        20         60   LABY(JJ) = 1H
                        RETURN
                        END

    REGISTER ALLOCATION
      1 REGISTERS ASSIGNED OVER THE LOOP BEGINNING AT LINE     19
      SUBROUTINE  SLOPE                            CDC 6600 FTN V3.0-P336 OPT=2  09/14/75. 17.27.31.      PAGE    1

                     SUBROUTINE SLOPE(X,PNDS,K)
                     COMMON /INOUT/ N5,N6
                     DIMENSION X(100),PNDS(100)
                     SUM =0.0
                     II = 0
                     DO 10 I=6,K,5
                     IF(I.GT.K) GO TO 15
                     S = (PNDS(I)-PNDS(I-5))/(X(I)-X(I-5))
                     SUM = S + SUM
                     II = II + 1
                  10  CONTINUE
                  15 CONTINUE
                     AVG = SUM/II
                     WRITE(N6,100) AVG
                 100 FORMAT(1H0,10X, " AVERAGE SLOPE OF POUNDS OF POLLUTANT VS. CUBIC F
                    1T. OF RUNOFF =  ",E12.5,/)
                     RETURN
                     END
      SUBROUTINE  SSXCY                                 CDC 6600 FTN V3.0-P336 OPT=2  09/14/75. 17.27.31.      PAGE     1

                  SUBROUTINE SSXCY(XCC,C,K,LX,LY,LABXC,LABY,ILAB)
                  DIMENSION XCC(100),C(100),LABXC(40),LABY(40)
                  XMIN = XCC(1)
                  XMAX = XCC(1)
                  YMIN = C(1)
                  YMAX = C(1)
                  DO 20 J = 1,K
                  IF(XCC(J).LT.XMIN) XMIN = XCC(J)
                  IF(XCC(J).GT.XMAX) YMAX = XCC(J)
                  IF(C(J).LT.YMIN) YMIN = C(J)
                  IF(C(J).GT.YMAX) YMAX = C(J)
               20 CONTINUE
                  XDEL = (XMAX-XMIN)/10.
                  YDEL = (YMAX-YMIN)/5.
                  CALL PLTR(XCC,C,K,XMIN,XMAX,XDEL,LX,YMIN,YMAX,YDEL,LY,LABXC,LABY,
                 1   ILAB)
                  RETURN
                  END
```

```
SUBROUTINE  LBVSLB                    CDC 6600 FTN V3.0-P336 OPT=2  04/14/75. 17.27.31.      PAGE     1

                SUBROUTINE LBVSLB(PNDX,PNDY,K,LX,LY,LABXP,LABYP,ILAB)
                COMMON /INOUT/ N5,N6
                DIMENSION PNDX(100),PNDY(100),LABXP(40),LABYP(40)
          C**** THIS SUBROUTINE WILL PLOT CUMULATIVE POUNDS OF ONE POLLUTANT
          C**** AGAINST ANOTHER.
          C
                XMIN = PNDX(1)
                XMAX = PNDX(1)
                YMIN = PNDY(1)
                YMAX = PNDY(1)
                DO 20 J = 1,K
                IF(PNDX(J).LT.XMIN) XMIN = PNDX(J)
                IF(PNDX(J).GT.XMAX) XMAX = PNDX(J)
                IF(PNDY(J).LT.YMIN) YMIN = PNDY(J)
                IF(PNDY(J).GT.YMAX) YMAX = PNDY(J)
             20 CONTINUE
                XDEL = (XMAX-XMIN)/10.
                YDEL = (YMAX-YMIN)/5.
          C
                CALL PLTR(PNDX,PNDY,K,XMIN,XMAX,XDEL,LX,YMIN,YMAX,YDEL,LY,LABXP,
               1          LABYP,ILAB)
                WRITE(N6,100)
            100 FORMAT(1H0,51H** NOTE  UNITS ARE CUMULATIVE POUNDS VS. CUMULATIVE,
               1                       7H POUNDS  )
                RETURN
                END
```

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      SUBROUTINE  FUNPLT                         CDC 6600 FTN V3.0-P336 OPT=2  09/14/75. 17.27.31.        PAGE     1

                    SUBROUTINE FUNPLT  (X,Y,K,LX,LY,LABX,LABY,ILAB)
                    COMMON /INOUT/ N5,N6
                    DIMENSION X(100),Y(100),LABX(40),LABY(40),XX(100),YY(100)
              C***     THIS SUBROUTINE IS USED TO PLOT X-Y VALUES AS WHATEVER FUNCTION
              C****     YOU CARE TO USE. SUCH AS  Y=X**2  OR WHATEVER
              C
              C****    FIRST MESS AROUND WITH THE NUMBERS TO GET PROPER X-Y VALUES
                    RETURN
                    DO 50 I=1,K
                    XX(I) = X(I)
                 50 YY(I) = Y(I)
                    DO 100 I=1,K
              C****   SET FUNCTION FOR X VALUES
                    IF(XX(I).LE..01) XX(I) =.01
                    IF(YY(I).LE..01) YY(I) =.01
                    XX(I) = ALOG10(XX(I))
                    YY(I) = ALOG10(YY(I))
                100  CONTINUE
              C*****        NOW FIND MIN,MAX, AND DELTA VALUES
                    XMIN = XX(1)
                    XMAX = XX(1)
                    YMIN = YY(1)
                    YMAX = YY(1)
                    DO 150 I=1,K
                    IF(XX(I).LT.XMIN) XMIN = XX(I)
                    IF(XX(I).GT.XMAX) XMAX = XX(I)
                    IF(YY(I).LT.YMIN) YMIN = YY(I)
                    IF(YY(I).GT.YMAX)  YMAX = YY(I)
                150  CONTINUE
                    XMIN = -1.0
                    XMAX = 3.4
                    YMIN = -2.0
                    YMAX =  3.4
                    XDEL = (XMAX-XMIN)/10.
                    YDEL = (YMAX-YMIN)/5.
              C*****          NOW PLOT VALUES
                    CALL PLTR(XX,YY,K,XMIN,XMAX,XDEL,LX,YMIN,YMAX,YDEL,LY,LABX,
                   1         LABY,ILAB)
              C
              C****       NOW FIX UP SOME KIND OF LABEL TO TELL WHAT YOU DID TO ORIGINAL VALUES
                    WRITE(N6,500)
                500  FORMAT(1H ,20(1H*),5X,4HNOTE,5X,20(1H*),/,1H ,5X,
                   1  50H THE X-AXIS IS THE LOG OF ORIGINAL VALUES                  ,
                   2  50H THE Y-AXIS IS THE LOG OF ORIGINAL VALUES                  )
                    RETURN
                    END
      SUBROUTINE  PLTR                         CDC 6600 FTN V3.0-P336 OPT=2  09/14/75. 17.27.31.      PAGE    1

                 SUBROUTINE PLTR(X,Y,N,XMIN,XMAX,XDEL,LX,YMIN,YMAX,YDEL,LY,LABY,LAB
                1Y,ILAB)
           C
           C     PURPOSE
           C       PRINTS A PLOT FOR A SINGLE CURVE
           C
           C     USAGE
           C       CALL PLTR(X,Y,N,XMAX,XMIN,XDEL,LX,YMAX,YMIN,YDEL,LY,LABX,LABY,
           C       ILAB)
           C
           C     DESCRIPTION OF PARAMETERS
           C       X      -VECTOR CONTAINING X VALUES TO BE PLOTTED
           C       Y      -VECTOR CONTAINING Y VALUES TO BE PLOTTED
           C       N      -NUMBER OF VALUES FOR X AND Y
           C       XMAX   -MAXIMUM SCALE MARK FOR X
           C       XMIN   -MINIMUN SCALE MARK FOR X
           C       XDEL   -INCREMENT FOR X SCALE
           C       LX     -NUMBER OF PRINT POSITIONS FOR X-AXIS
           C       YMAX   -MAXIMUM SCALE MARK FOR Y
           C       YMIN   -MINIMUM SCALE MARK FOR Y
           C       YDEL   -INCREMENT FOR Y SCALE
           C       LY     -NUMBER OF LINES FOR Y-AXIS
           C       LABX   -LABEL FOR X-AXIS
           C       LABY   -LABEL FOR Y-AXIS
           C       ILAB   -DEFAULT SWITCH FOR USING AN X AND Y FOR LABELS
           C
           C     REMARKS
           C       NONE
           C
           C     METHOD
           C       DIRECT CALCULATION
           C
           C     SUBPROGRAMS CALLED
           C       NONE
           C
           C     THIS SUBROUTINE WAS WRITTEN BY MR. M. SMITH
                 DIMENSION X(100),Y(100),LABX(40),LABY(40),LINE(150),XXXX(30)
                 DATA NXAX/1H-/,NYAX/1HI/,NMRK/1H+/,NPNT/1H*/,NBLK/1H /,NLPN/1H(/,
                1N1XC/3H1X,/,NFTP/4HF10./,NZER/2H0,/,NTWO/2H2,/,NRPN/1H)/,NXXX/1HX/
                2,NYYY/1HY/
                 ITRACE=1
                 ITRACE = 0
                 IFLAG = 100
                 IF(ITRACE.EQ.1) WRITE(6,1000) IFLAG
                 IF(ILAB.EQ.1) GO TO 20
                 IFLAG = 101
                 IF(ITRACE.EQ.1) WRITE(6,1000) IFLAG
           C**** IF NO LABEL IS SPECIFIED, ONE IS MADE
                 DO 10 I=1,40
                 LABX(I)=NBLK
              10 LABY(I)=NBLK
                 IFLAG = 102
                 IF(ITRACE.EQ.1) WRITE(6,1000) IFLAG
                 LABX(20)=NXXX
                 LABY(20)=NYYY
```

```
C**** COMPUTE PRINT POSITIONS PER X SCALE DIVISION
   20 LXDL=(LX-1)*XDEL/(XMAX-XMIN)+0.1
      IFLAG = 103
      IF(ITRACE.EQ.1) WRITE(6,1000) IFLAG
C**** COMPUTE LINES PER Y SCALE DIVISION
      LYDL=(LY-1)*YDEL/(YMAX-YMIN)+0.1
      IF(ITRACE.EQ.1) WRITE(6,1000) IFLAG
C**** COMPUTE X SCALING FACTOR
      XSCL=LXDL/XDEL
      IF(ITRACE.EQ.1) WRITE(6,1000) IFLAG
C**** COMPUTE Y SCALING FACTOR
      YSCL=LYDL/YDEL
      IF(ITRACE.EQ.1) WRITE(6,1000) IFLAG
C**** INITIALIZE POINTER FOR Y-AXIS LABEL
      L=(40-LY)/2
      IF(ITRACE.EQ.1) WRITE(6,1000) IFLAG
C**** INITIALIZE LINE COUNT
      I=LY-1
      IFLAG = 104
      IF(ITRACE.EQ.1) WRITE(6,1000) IFLAG
C**** INITIALIZE SCALE VALUE FOR Y-AXIS
      YS=YMAX
      YP=ABS(YS)
C**** PREPARE TOP LINE OR BOTTOM LINE
      IFLAG = 105
      IF(ITRACE.EQ.1) WRITE(6,1000) IFLAG
   30 DO 40 J=1,LX
   40 LINE(J)=NXAX
      IFLAG = 106
      IF(ITRACE.EQ.1) WRITE(6,1000) IFLAG
      DO 50 J=1,LX,LXDL
   50 LINE(J)=NMRK
      IFLAG = 107
      IF(ITRACE.EQ.1) WRITE(6,1000) IFLAG
      LINE(LX)=NMRK
      IS=1
C**** TEST FOR SCALE DIVISION
      IF(LYDL*(I/LYDL).EQ.I)GO TO 70
      IFLAG = 108
      IF(ITRACE.EQ.1) WRITE(6,1000) IFLAG
      GO TO 80
C**** TEST FOR SCALE DIVISION
   60 IF(LYDL*(I/LYDL).EQ.I)GO TO 70
C**** PREPARE LINE FOR NO SCALE VALUE
      IS=1
      IF(I.EQ.LY)GO TO 80
      LINE(1)=NYAX
      LINE(LX)=NYAX
      IFLAG = 110
      IF(ITRACE.EQ.1) WRITE(6,1000) IFLAG
      GO TO 80
C**** PREPARE LINE FOR SCALE VALUE
   70 IS=3
      IFLAG = 111
      IF(ITRACE.EQ.1) WRITE(6,1000) IFLAG
      SUBROUTINE  PLTR                               CDC 6600 FTN V3.0-P336 OPT=2  09/14/75. 17.27.31.      PAGE    3

            LINE(1)=NMRK
            LINE(LX)=NMRK
      C**** TEST FOR POINTS
            IFLAG = 112
            IF(ITRACE.EQ.1) WRITE(6,1000) IFLAG
         80 DO 90 J=1,N
            JY=(Y(J)-YMIN)*YSCL+0.5
            IF(JY.NE.I)GO TO 90
      C**** PLOT POINT
            JX=(X(J)-XMIN)*XSCL+1.5
      C**** TEST FOR POINT IN X-AXIS RANGE
            IF(JX.LE.LX.AND.JX.GT.0)LINE(JX)=NPNT
         90 CONTINUE
            IFLAG = 113
            IF(ITRACE.EQ.1) WRITE(6,1000) IFLAG
      C**** TEST FOR Y-AXIS LABEL
            IF(L.GT.0.AND.L.LE.40)IS=IS+1
            GO TO(100,110,120,130),IS
      C**** NO SCALE - NO LABEL
        100 WRITE(6,400)(LINE(J),J=1,LX)
            GO TO 140
      C**** NO SCALE - LABEL
        110 WRITE(6,401)LABY(L),(LINE(J),J=1,LX)
            GO TO 140
      C**** SCALE - NO LABEL
        120 IF(YP.GT.10.)WRITE(6,402)YS,(LINE(J),J=1,LX)
            IF(YP.LE.10.)WRITE(6,403)YS,(LINE(J),J=1,LX)
            YS=YS-YDEL
            GO TO 140
      C**** SCALE - LABEL
        130 IF(YP.GT.10.)WRITE(6,404)LABY(L),YS,(LINE(J),J=1,LX)
            IF(YP.LE.10.)WRITE(6,405)LABY(L),YS,(LINE(J),J=1,LX)
            YS=YS-YDEL
      C**** UPDATE LABEL POINTER
        140 L=L+1
            IFLAG = 16
            IF(ITRACE.EQ.1) WRITE(6,1000) IFLAG
      C**** TEST FOR END OF GRAPH
            IF(I.EQ.0)GO TO 160
      C**** TEST FOR LAST LINE OF GRAPH
            I=I-1
            IF(I.EQ.0)GO TO 30
      C**** BLANK OUT LINE
            DO 150 J=1,LX
            LINE(J)=NBLK
        150 CONTINUE
            GO TO 60
      C**** BLANK OUT LINE FOR OBJECT TIME FORMAT
        160 DO 170 J=1,150
            LINE(J)=NBLK
        170 CONTINUE
      C**** TEST SIZE OF VALUE FOR X-AXIS SCALE
            J=11
            IF(ABS(XMAX).GT.10.)J=10
      C**** STORE LEFT PAREN
```

```
          LINE(I)=NLPN
          I=2
C**** STORE SPACING SPECIFICATIONS
          DO 180 K=1,J
          LINE(I)=NIXC
          I=I+1
      180 CONTINUE
C**** COMPUTE NUMBER OF X-AXIS DIVISIONS
          NXDV=(LX-1)/LXDL+1
          NXDV=LX/LXDL+1
C**** COMPUTE NUMBER OF SPACING SPECIFICATIONS
          NS=LXDL-10
C**** INITIALIZE COUNTER FOR NUMBER OF DIVISIONS
          K=1
C**** STORE F-SPECIFICATION
      190 LINE(I)=NFTP
          I=I+1
C**** STORE NUMBER OF DECIMAL PLACES
          IF(J.EQ.11) LINE(I)=NTWO
          IF(J.EQ.10) LINE(I)=NZER
          I=I+1
C**** TEST FOR ALL DIVISIONS
          IF(NXDV.EQ.K) GO TO 220
C**** STORE SPACING SPECIFICATIONS
          IF(NS.LE.0) GO TO 210
          DO 200 L=1,NS
          LINE(I)=NIXC
          I=I+1
      200 CONTINUE
C**** UPDATE NUMBER OF DIVISIONS COUNTER
      210 K=K+1
          GO TO 190
C**** STORE RIGHT PAREN
      220 LINE(I)=NRPN
C**** COMPUTE X-AXIS SCALE VALUES
          XXXX(1)=XMIN
          DO 230 I=2,NXDV
      230 XXXX(I)=XXXX(I-1)+XDEL
C**** PRINT X-AXIS SCALE
          WRITE(6,LINE) (XXXX(I),I=1,NXDV)
C**** BLANK OUT LINE
          DO 240 I=1,150
      240 LINE(I)=NBLK
C**** CENTER X-AXIS LABEL
          L=(40-LX)/2
C**** STORE X-AXIS LABEL
          DO 250 I=1,LX
          IF(L.GT.0) LINE(I)=LABX(L)
C**** TEST FOR END OF LABEL
          IF(L.EQ.40) GO TO 260
C**** UPDATE POINTER
          L=L+1
      250 CONTINUE
C**** PRINT X-AXIS LABEL
      260 WRITE(6,406) (LINE(I),I=1,LX)
```

```
        SUBROUTINE  PLTR                                  CDC 6600 FTN V3.0-P336 OPT=2  09/14/75. 17.27.31.       PAGE      5

                          400 FORMAT(18X,112A1)
                          401 FORMAT(5X,A1,12X,112A1)
                          402 FORMAT(6X,F12.0,112A1)
                          403 FORMAT(6X,F12.2,112A1)
                          404 FORMAT(5X,A1,F12.0,112A1)
                          405 FORMAT(5X,A1,F12.2,112A1)
                          406 FORMAT("0",17X,112A1)
                         1000  FORMAT(10X,"  *******  TRACER    IFLAG =",I5,/)
                         1001  FORMAT(" "," LXDL =",I5," LX =",I5,"XDEL =",F10.3,"XMAX =",F10.3,
                            1   "XMIN =",F10.3,/)
                               RETURN
                               END

REGISTER ALLOCATION
   1 REGISTERS ASSIGNED OVER THE LOOP BEGINNING AT LINE     49
   1 REGISTERS ASSIGNED OVER THE LOOP BEGINNING AT LINE     82
   1 REGISTERS ASSIGNED OVER THE LOOP BEGINNING AT LINE     86
   1 REGISTERS ASSIGNED OVER THE LOOP BEGINNING AT LINE    154
   1 REGISTERS ASSIGNED OVER THE LOOP BEGINNING AT LINE    159
   2 REGISTERS ASSIGNED OVER THE LOOP BEGINNING AT LINE    169
   2 REGISTERS ASSIGNED OVER THE LOOP BEGINNING AT LINE    191
   1 REGISTERS ASSIGNED OVER THE LOOP BEGINNING AT LINE    207
```

APPENDIX B

RUNOFF BLOCK CARD DATA

CARD GROUP 1

Format	Card Columns	Description	Variable Name	Default Value
20A4	1-80	Title Cards: two cards with heading to be printed on output.	Title	Blanks

RUNOFF BLOCK CARD DATA
CARD GROUP 2

Format	Card Columns	Description	Variable Name	Default Value
		Control card: one card.		
2I5	1-5	Basin identification number.	BASIN	0
	6-10	Number of time-steps to be calculated (maximum = 150).	NSTEP	None
I13	11-13	Hour of start of storm (24-hour clock).	NHR	0
I12	14-15	Minutes of start of storm.	NMN	0
F5.0	16-20	Integration period (time step), min.	DELT	None
I15	21-25	Number of hyetographs (rain gages) (maximum = 10).	NRGAG	None
F5.0	26-30	Percent of impervious area with zero detention (immediate runoff)	PCTZER	25.0
I15	31-35	IROS = 1, Erosion for subcatchment is to be modeled.	IROS	0
F5.0	36-40	If IROS = 1, Highest average 30-minute rainfall intensity, in/hr.	RAINIT	0.0

RUNOFF BLOCK CARD DATA
CARD GROUP 3

Format	Card Columns	Description	Variable Name	Default Value
		Rainfall control card.		
I15	1-5	Number of data points for each hyetograph (maximum = 200).	NHISTO	None
F5.0	6-10	Time interval between values, min.	THISTO	None
		Time interval must be equal to time step (DELT) or integer multiple of time step.		

RUNOFF BLOCK CARD DATA

CARD GROUP 4

Format	Card Columns	Description	Variable Name	Default Value
		REPEAT CARD GROUP 4 FOR EACH HYETOGRAPH - NREAG Times Rainfall hyetograph cards: 10 intervals per card (maximum number of values = 200).[a]		
10F5.0	1-5	Rainfall intensity, first interval, in/hr.	RAIN(1)	None
	6-10	Rainfall intensity, second interval, in/hr.	RAIN(2)	None
	11-15	Rainfall intensity, third interval, in/hr.	RAIN(3)	None
	16-20	Rainfall intensity, fourth interval, in/hr.	RAIN(4)	None

[a] Problems may occur when zero rainfall occurs several time-steps before the actual start of the rainfall (the computer underflows).

RUNOFF BLOCK CARD DATA
CARD GROUP 5

Format	Card Columns	Description	Variable Name	Default Value
		REPEAT CARD 5 FOR EACH GUTTER/PIPE. Gutter/pipe cards: one card per gutter/pipe (if none, leave out) (maximum number = 200).		
I10	1-10	Gutter/pipe number.	NAMEG	None
2I5	11-15	Gutter or inlet number for drainage.[b]	NGTO	None
	16-20	= 1 for gutters = 2 for pipes	NP	None
7F8.0	21-28	Bottom width of gutter or pipe diameter, ft.	GWIDTH=G1	None
	29-36	Length of gutter, ft. Gutter length affects outflow by increasing or decreasing storage.	GLEN =G2	None
	37-44	Invert slope, ft/ft. Rise	GSLOPE-G3	None
	45-52	Left-hand side slope, ft/ft.	GS1 =G4	None
	53-60	Right-hand side slope, ft/ft.	GS2 =G4	None
	61-68	Mannings coefficient.	GN =G6	0.018
	69-76	Depth of gutter when full, in. For open channel (gutter) flow channel depth should be large enough to prevent surcharging	DFULL=G7	10.0

Numbers may be arbitrarily chosen, However, if inlet number is to correspond to inlet manhole for Transport Block, it must be $\leq$ 1000. The maximum total number of inlets must be $\leq$ 50 for input to receiving or $\leq$ 70 for input to Transport.

RUNOFF BLOCK CARD DATA

CARD GROUP 6

Format	Card Columns	Description	Variable Name	Default Value
		Blank card to terminate gutter cards: one card (must always be included).		

RUNOFF BLOCK CARD DATA

CARD GROUP 6A

OPTIONAL CARD

Format	Card Columns	Description	Variable Name	Default Value
I5	9-10	Will change all sub-catchment cards following -1 for changes to group 7		none

RUNOFF BLOCK CARD DATA
CARD GROUP 7

Format	Card Columns	Description	Variable Name	Default Value
		REPEAT CARD 7 FOR EACH SUBCATCHMENT.		
3I5	1-5	Hyetograph number (based on the order in which they are read in).	JK	1
	6-10	Subcatchment number.[a]	NAMEW	None
	11-15	Gutter or manhole number for drainage.[a,b]	NGTO	None
10F5.0	16-20	Width of subcatchment, ft.*	WWIDTH=W1	None
		This term actually refers to the physical width of overland flow in the subcatchment and may be obtained as illustrated under Instructions for Data Preparation.[c]		
	21-25	Area of subcatchment, acres.	WAREA =W2	None
	26-30	Percent imperviousness of subcatchment.	PCIMP =W3	0.001
	31-35	Ground slope, ft/ft.	WSLOPE=W4	0.030
Resistance factor. (Manning's n)	36-40	Impervious area	W5 =W5	0.013
	41-45	Pervious area.	W6 =W6	0.250
Retention storage, in.	46-50	Impervious area.	WSTORE=W7	0.062
	51-55	Pervious area.	WSTORE=W8	0.184
	56-60	Maximum infiltration rate, in/hr.*	WLMAX=W9	3.00
	61-65	Minimum infiltration rate, in/hr.*	WLMIN=W10	0.52
	66-75	Decay rate of infiltration in Horton's equation, 1/sec.*	DECAY=WLL	0.00115

CONTD. GROUP 7

[a] Numbers may be arbitrarily chosen. However, if inlet number is to correspond in inlet manhole for Transport Block, it must be $\leq$ 1000. The maximum total number of inlets must be $\leq$ 70 for input to Transport or $\leq$ for input to Receiving.

[b] Need one inlet or gutter/pipe for each subcatchment basin.

[c] As an approximation, twice the length of the pricipal drainage couduit through the subcatchment may be used.

*Major variables used in calibration

RUNOFF BLOCK CARD DATA

CARD GROUP 8

Format	Card Columns	Description	Variable Name	Default Value
		Blank card to terminate subcatchment cards: one card.		

RUNOFF BLOCK CARD DATA
CARD GROUP 9

Format	Card Columns	Description	Variable Name	Default Value
		SURFACE QUALITY CONTROL CARD		
I10	1-10	Surface Quality NWS = 0, no quality modeled NQS = 1, quality to be modeled	NQS	0
		********THE FOLLOWING PARAMETERS ARE******** NEEDED ONLY IF NQS = 1:		
2F10.0	11-20	Number of dry days prior to this storm in which the accumulative rainfall is less than 1.0 inch.	DRYDAY	0.0
	21-30	Street cleaning frequency, days.	CLFEQ	0.0
I10	31-40	Number of street sweeper passes.	NPASS	
2F10.0	41-50	Catchbasin storage volume, ft^3.	CBVOL	0.0
	51-60	Concentration of BOD (mg/l), of the stored water in each catchbasin (100 recommended)		
I5	61-65	Method for calculating suspended solids ISS = 0, same as for all other pollutants (Vol. I). ISS = 1, special technique. Same as in original release 1 of the SWMM. ISS = 2, special EH&A method using loading rates and loading factors for up to 20 land uses.	ISS	0
I5	66-70	If ISS = 2 enter number of land uses for which loading factors will be input ≤ 20	NLU	0

RUNOFF BLOCK CARD DATA
CARD GROUP 10

Format	Card Columns	Description	Variable Name	Default Value
		Erosion card.		
		If IROS = 0 on Card 2, SKIP TO CARD 11 OR 10A (IF ISS = 02)		
I15	1-5	Subcatchment number (must be read in same order as Card Group 7.	N	None
5F5.0	6-10	Area of subcatchment subject to erosion, acres.	ERODAR(N)	0.0
	11-15	Flow distance in feet from point of origin of overland flow over erodible area to point at which runoff enters gutter or manhole.	ERLEN(N)	0.0
	16-20	Soil factor 'K'.[a]	SOILF(N)	0.0
	21-25	Cropping management factor 'C'.[b]	CROPMF(N)	0.0
	26-30	Control practice factor 'P'.[b]	CONTPF(N)	0.0

[a] See instructions for data preparation

[b] See instructions for data preparation and consult with local Soil Conservation Service or Agricultural Research Service.

RUNOFF BLOCK CARD DATA
CARD GROUP 10A

Format	Card Columns	Description	Variable Name	Default Value
		EH&A Quality Method		
8F5.2	1-5	Pollutant removal[9] factor for first type of pollutant	PRFACT	0
		Note: The pollutant removal factor establishes the "rate" at which the available pollution (total ? is removed by runoff.		
	6-10	Pollutant removal factor for second type of pollutant		
		Repeat for each of remaining pollutant types		

---

[a] Used only if ISS= 2 on card group 9

RUNOFF BLOCK CARD DATA
CARD GROUP 10B

Format	Card Columns	Description	Variable Name	Default Value
		Loading Factors, One Card for Each Land Use (variable NLU (number of land uses entered on card group 9, columns (66-70)		
8F10.2	1-10	Biological oxygen demand		None
	11-20	Suspended solids	6	None
	21-30	Coliforms		None
	31-40	Chemical Oxygen demands		None
	41-50	Settleable solids		None
	51-60	Nitrates		None
	61-70	Phosphates		None
	71-80	K-nitrogen		None
		Note: Gives the total available material (pollutant) per unit acre/population/income etc. Because total accumulation is undivided the number of dry days (DRYDAY) input on card 9 should be equal to 1.0		

RUNOFF BLOCK CARD DATA

CARD GROUP 11

Format	Card Columns	Description	Variable Name	Default Value
		SUBCATCHMENT SURFACE QUALITY DATA CARDS (one card per subcatchment and must be read in the same order as Card Group 7). If NWS = 0, skip to Card 12.		
5X	1-5	Not used.		
2I5	6-10	Subcatchment number	N	None
	11-15	Land use classification. If ISS = 1, = 1, For single family residential, = 2, For multiple family residential, = 3, For commercial, = 4, For industrial, = 5, For undeveloped or park lands. If ISS = 2, enter 1-20 for land use type	KL	5
2F10.0	16-25	Number of catchbasins in subcatchment.	BA	None
	26-35	Total length of all gutters within subcatchment, hundreds of feet. If ISS = 2, enter area, population or other parameter used in determining quantity of pollution using loading factors (PFACT) in card group 10B.	GQ	None

RUNOFF BLOCK CARD DATA

CARD GROUP 12

Format	Card Columns	Description	Variable Name	Default Value
		GUTTER/INLET PRINT CONTROL; ONE CARD		
2I5	1-5	Number of gutters/inletsfor which flows are to be printed (maximum = 200).	NPRNT	0
	6-10	Number of time-steps between printings.	INTERV	None

RUNOFF BLOCK CARD DATA
CARD GROUP 13

Format	Card Columns	Description	Variable Name	Default Value
		IF NPRNT = 0, SKIP CARD 13.		
		GUTTER/INLET PRINT CARDS: 16 VALUES/CARD.		
16I5	1-5	Gutter/inlet numbers for which flows and/or pollutants are to be printed.	IPRNT(1)	None
	6-10		IPRNT(2)	None
	11-15		IPRNT(3)	None
	.		.	
	.		.	
	.		.	
	.		.	
	.		IPRNT(NPRNT)	None

Estimated Limits of Depression Storage

Land Slope	Alfalfa	Pasture	Contour Furrows
0	0.1-0.3	0.04-0.26	2.0-3.0
2	0.07-0.15	0.02-0.17	
4	....	0.02-0.13	
6	0.05	0.02-0.12	1.0-2.1
8	0.03-0.10	0.02-0.11	
10	0.02-0.08	0.02-0.10	
12	0.02-0.07	0.02-0.09	0.5-1.3
16	0.02-0.06	0.02-0.07	0.2-0.8
20	....		0.0-0.6
24	....		0.0-0.3

Estimates of Manning's Roughness Coefficient for Overland-flow

Smooth Asphalt	0.012
Asphalt or concrete paving	0.014
Packed clay	0.03
Light turf	0.20
Dense turf	0.35
Dense shrubbery & forest litter	

PORPAV BLOCK CARD DATA

CARD GROUP 1

Format	Card Columns	Description	Variable Name	Default Value
20A4	1-80	Title Cards: two cards with headings to be printed on output	Title	Blank Cards

PORPAV BLOCK CARD DATA

CARD GROUP 2

Format	Card Columns	Description	Variable Name	Default Value
		VARIABLE ENUMERATION CARD		
10X	1-10	Card Identification	-	Blank
I5	11-15	Number of subareas contributing flow	IAREA	0
I5	16-20	Number of time intervals for input rainfall data	NRAIN	0
I5	21-25	Number of computational steps	KSTEP	None
I5	26-30	Number of time intervals for input runoff data	JRUNOF	0
I5	31-35	Gutter/pipe number into which surface outflows are delivered	IGUTTN	None

PORPAV BLOCK CARD DATA

CARD GROUP 3

Format	Card Columns	Description	Variable Name	Default Value
		SUBAREA CHARACTERISTICS CARD REPEAT CARD GROUP 3 OF EACH SUBAREA CONTRIBUTING FLOW		
10X	1-10	Card Identification	-	Blank
F10.3	11-20	Flow retardance coefficients*	C	None
F10.3	21-30	Subarea slope	S	None
F10.3	31-40	Flow length of subarea, ft	L	None
F10.3	41-50	Flow width of subarea, ft	W	None

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*Very smooth asphalt pavement	0.007
Tar and sand pavement	0.0075
Crushed-slate roofing paper	0.0082
Concrete	0.012
Tar and gravel pavement	0.017
Closely clipped sod	0.046
Dense bluegrass turf	0.060

PORPAV BLOCK CARD DATA

CARD GROUP 4

Format	Card Columns	Description	Variable Name	Default Value
		RUNOFF HYDROGRAPH If JRUNOF > 0 and NRAIN = 0 on Card Group 2 otherwise go to Card Group 5		
10X	1-10	Card Identification	-	Blank
F10.3	11-20	Discharge during first time interval, cfs	I	None
F10.3	21-30	Discharge during second time interval, cfs	INFLOW	None

Repeat for a total of JRUNOF times
with 7 values per card

PORPAV BLOCK CARD DATA

CARD GROUP 5

Format	Card Columns	Description	Variable Name	Default Value
		RAINFALL HYETOGRAPH		
		If JRUNOF = 0 and NRAIN >0 on Card Group 2 otherwise go to Card Group 6		
10X	1-10	Card Identification	-	Blank
F10.3	11-20	Rainfall during first time interval, inches	RAIN	None
F10.3	21-30	Rainfall during second time interval, inches	RAIN	None

Repeat for a total of NRAIN times, with 7 values per card

PORPAV BLOCK CARD DATA

CARD GROUP 6

Format	Card Columns	Description	Variable Name	Default Value
		COMPUTATIONAL TIME DATA		
10X	1-10	Card Identification	-	Blank
F10.3	11-20	Starting clock hour for computation of evaporation	TSTHR	None
F10.3	21-30	Starting clock minute for computation of evaporation	TSTMIN	None
F10.3	31-40	Hydrograph computational interval, minutes	TI	None

PORPAV BLOCK CARD DATA

CARD GROUP 7

Format	Card Columns	Description	Variable Name	Default Value
		EVAPORATION DATA		
10X	1-10	Card Identification		
I10	11-20	Evaporation rate identification monthly = 30 weekly = 7 daily = 1	NEVAP	None
F10.3	21-30	Evaporation rate in inches corresponding to NEVAP		

PORPAV BLOCK CARD DATA

CARD GROUP 8

Format	Card Columns	Description	Variable Name	Default Value
		PAVEMENT STORAGE DATA		
10X	1-10	Card Identification	-	Blank
F5.3	11-15	Pavement permeability, in/hr	KP	0
F5.3	16-20	Pavement thickness, in	DP	0
F5.3	21-25	Pavement porosity	PORP	0
F5.3	26-30	Base permeability, in/hr	KS	0
F5.3	31-35	Base thickness, in	DS	0
F5.3	36-40	Base porosity	PORS	0
F5.3	41-45	Natural ground permeability, in/hr	KG	0
F5.3	46-50	Natural ground thickness	DD	0
F5.3	51-55	Natural ground porosity	DG	0
F5.3	56-60	Capacity of drain, in/hr	KD	0
F5.3	61-65	Distance from bottom of base to water table or drain, in	DG	0

PORPAV BLOCK CARD DATA

CARD GROUP 9

Format	Card Columns	Description	Variable Name	Default Value
10X	1-10	Card Identification	-	Blank
F10.3	11-20	Width of pavement, ft	WID	None
F10.3	21-30	Length of pavement, ft	XLEN	None
F10.3	31-40	Slope of pavement	SPAVE	None
F10.3	41-50	Length of downstream edge of pavement, ft	DSLEN	None
F10.3	51-60	Roughness coefficient for pavement	XN	None
F10.3	61-70	Weir coefficients for horizontal pavement	CWEIR	None
I5	71-75	Length of weir, ft	LWEIR	None
I5	76-80	Impervious lining 0 if impervious lining is used 99 if no impervious lining is used	ISEAL	None

PORPAV BLOCK CARD DATA

CARD GROUP 10

Format	Card Columns	Description	Variable Name	Default Value
		INITIAL STORAGE DATA		
10X	1-10	Card Identification	-	Blank
F10.3	11-20	Initial storage on the pavement surface, in	SURDEP	None
F10.3	21-30	Initial storage in the pavement, in	STORP	None
F10.3	31-40	Initial storage in the base, in	STORS	None
F10.3	41-50	Initial storage in the natural ground, in	STORG	None
F10.3	51-60	Design storage on the pavement surface that will not runoff but is only allowed to drain through pavement, in	DEDDEP	None
F10.3	61-70	Storage constant of natural ground used to determine lateral outflow approximately equal to specific yield of the natural ground.	STRCON	None

BASFLO BLOCK CARD DATA

CARD GROUP 1

Format	Card Columns	Description	Variable Name	Default Value
		HYDROGRAPH AND GROUNDWATER DATA		
I10	1-10	Identification number of hydrograph input from Transport Block	IDOUT	None
I10	11-20	Number of rescession coefficients to be read in	KRES	None
I10	21-30	Type of groundwater recession 1 if constant groundwater flow 2 if linearly decreasing groundwater flow 3 if exponentially decreasing groundwater flow	IGRND	None
F10.0	31-40	Initial groundwater flow, cfs	QCOEF	None
F10.0	41-50	Groundwater recession rate 0 for IGRND = 1 slope term for IGRND = 2 exponent for IGRND = 3	GSLOPK	None

BASFLO BLOCK CARD DATA

CARD GROUP 2

Format	Card Columns	Description	Variable Name	Default Value
		RESCESSION DATA		
		Recession rates are computed by the following equation: Recession rate = RESCI (QLNRES) + RESC2		
F10.0	1-10	Flow at start of specific recession, cfs	QRES	None
F10.0	11-20	Natural logarithm of QRES	QLNRES	None
F10.0	21-30	Slope coefficient	RESC1	None
F10.0	31-40	Intercept	RESC2	None

CSTANL BLOCK CARD DATA

CARD GROUP 1

Format	Card Columns	Description	Variable Name	Default Value
I3	1-3	Number of subcatchments for which costs will be determined	N	Name

CSTANL BLOCK CARD DATA

CARD GROUP 2

Format	Card Columns	Description	Variable Name	Default Value
DATA FOR COST ANALYSIS OF NATURAL DRAINAGE Repeat Card Group 2 for each Subcatchment (N times)				
ID	I-3	Identification number for each subarea	SUBN	None
F9.2	4-12	Cost of drainage for conventional systems, $/ac	DCONV	1700
F9.2	13-21	Cost of drainage for natural systems, $/ac	DNAT	*
F9.2	22-30	Subcatchment areas, ac	TAREA	None
F9.2	31-39	Right of way area, ac	AROW	0
F9.2	40-48	Cost of right of way, $/ac	XROW	None
F9.2	49-57	Cost of clearing, $/ac	XCLR	None
F9.2	58-66	Engineering News-Record Construction Index at time cost data were developed	ENR	0
F9.2	67-74	Engineering News-Record Construction Index at present time	PENR	0

TRANSPORT BLOCK DATA CARDS

CARD GROUP 1

Format	Card Columns	Description	Variable Name	Default Value
16I5	1-5	Number of sewer cross-sectional shapes, in addition to the 13 program-supplied for which element routing parameters are to follow (maximum value = 2	NKLASS	0
	8-10	Control parameter for printing out flow routing parameters for all shapes, i.e. KPRINT = 0 to suppress printing, KPRINT = 1 to allow printing (for all shapes, program-supplied and additional)	KPRINT	0
	11-15	To use EH&A developed natural section (NATSEC) subroutine set NCHANNEL = 1	NCHANNEL	0

CARD GROUPS 2 THRU 10 ARE REQUIRED ONLY
IF USER SUPPLIED (EXCLUDING NATURAL SECTIONS)
CROSS-SECTIONS ARE TO BE INPUTED..........

TRANSPORT BLOCK DATA CARDS

CARD GROUP 2

DELETE CARD GROUPS 2 THRU 10 IF NKLASS OR NCHANNEL = 0

Format	Card Columns	Description	Variable Name	Default Value
		Name of user-supplied shapes,	NAME	
204A	1-16	16-letter name of shape 1.	NAME(I,14)	None
	17-32	16-letter name of shape	NAME(I,15)	None

TRANSPORT BLOCK DATA CARDS

CARD GROUP 3

Format	Card Columns	Description	Variable Name	Default Value
		Number of values of DNORM to be supplied (maximum value = 51, minimum value = 2).	NN	
16I5	4-5	Number of values for shape 1.	NN(14)	None
	9-10	Number of values for shape 2.	NN(2)	None

TRANSPORT BLOCK DATA CARDS

CARD GROUP 4

Format	Card Columns	Description	Variable Name	Default Value
		Number of values of QNORM to be read (maximum value = 51, minimum value = 2).	MM	
16I5	4-5	Number of values for shape 1.	MM(14)	None
	9-10	Number of values for shape 2.	MM(15)	None

TRANSPORT BLOCK DATA CARDS

CARD GROUP 5

Format	Card Columns	Description	Variable Name	Default Value
		Value of A/A_f[a] corresponding to the maximum Q/Q_f[b] value for each shape.	ALFMAX	
8F10.5	1-10	A/A_f value for shape 1.	ALFMAX(14)	None
	11-20	A/A_f value for shape 2.	ALFMAX(15)	None

---

[a] A/A_f = ANORM if the cross-sectional flow area divided by the cross-sectional flow area of the pipe running full. Tabular values of ANORM are generated in the program by dividing the ANORM axis (0.0 - 1.0) into NN-1 or MM-1 equal divisions.

[b] Q/Q_f = QNORM is the flow rate divided by the flow rate of the conduit flowing full.

TRANSPORT BLOCK DATA CARDS
CARD GROUP 6

Format	Card Columns	Description	Variable Name	Default Value
		Maximum Q/Q_f value for each shape.	PSIMAX	
8F10.5	1-10	Maximum Q/Q_f value for shape 1.	PSIMAX(14)	None
	11-20	Maximum Q/Q_f value for shape 2.	PSIMAX(15)	None

TRANSPORT BLOCK DATA CARDS

CARD GROUP 7

Format	Card Columns	Description	Variable Name	Default Value
		Factor used to determine full flow area for each shape, i.e., for use in AFULL = AFACT(GEOMI)^2.	AFACT	
8F10.5	1-10	Factor for shape 1.	AFACT(14)	None
	11-20	Factor for shape 2.	AFACT(15)	None

TRANSPORT BLOCK DATA CARDS

CARD GROUP 8

Format	Card Columns	Description	Variable Name	Default Value
		Factor used to determine full flow hydraulic radius for each shape, i.e., for use in equation. FADH = RFACT(GEOM1).	RFACT	
8F10.5	1-10	Factor for shape 1.	RFACT(14)	None
	11-20	Factor for shape 2.	RFACT(15)	None

TRANSPORT BLOCK DATA CARDS

CARD GROUP 9

Format	Card Columns	Description	Variable Name	Default Value
		REPEAT CARD GROUP 9 FOR EACH ADDED SHAPE.		
		Input of tabular data (depth of flow, y, divided by total depth of conduit, y_f (y/y_f)) for each added shape corresponding to the NN-1 equal divisions of A/A_f of the conduit as given by NN on card group 3.[a]	DNORM	
8F10.5	1-10	First value for y/y_f for shape 1.[b]	DORM(I,1)	None
	11-20	Second value for y/y_f for shape.	DNOWM(I,2)	None
		Last value of y/y_f for shape 1.	DNOWM(I,NN(I))	
		(Total of NN(14)/8 + NN (15)/8 data cards)		

---

[a] y/y_f = DNORM is the depth of flow, y, divided by the maximum flow depth, y_f (e.g., diameter of a circular conduit).

[b] changed from draft manual

TRANSPORT BLOCK DATA CARDS
CARD GROUP 10

Format	Card Columns	Description	Variable Name	Default Value
		REPEAT CARD GROUP 10 FOR EACH ADDED SHAPE.		
		Input of tabular data (flow rate, Q, divided by the flow rate of the conduit running full, Q_f (Q/Q_f)). for each added shape corresponding to the MM-1 equal division of A/A_f of the conduit as given by MM on card group 4.	QNORM	
8F10.5	1-10	First value of Q/Q_f for shape 1.	QNORM(I,1)	None
	11-20	Second value of Q/Q_f for shape 1.	QNORM(I,2)	None
	. . . .		. .	
		Last value for Q/Q_f shape 1.	QNORM(I;MM(I))	None
		(Total of MM(14)/8 + MM(15)/8 data cards)		

CARD GROUPS 10A THRU 10D ARE REQUIRED
ONLY IF NATURAL CROSS-SECTIONS ARE TO
BE INPUTED (NCHANNEL=1 or 2).........

NATURAL SECTIONS INPUT

The SWMM is able to input a maximum of 10 "natural" cross-sections. However, with the use of GEOM1 variable, a large number of cross-section can be generated and subsequently utilized. By setting GEOM1 equal to the actual depth of the cross-section (that is, the difference in elevation between the lowest end point of the cross-section and the bottom of channel elevation.) the cross-section remains dimensionally the same size as inputed by the user. If, however, the user specifies a GEOM1 either larger or smaller than the actual (measured) depth the entire cross-section will be expanded or contracted in proportion to that change.

For example, if you have a cross-section which is 20 feet deep but specify for GEOM1 10 feet, 10/20=0.5, which means that the entire cross-section will be reduced in size by 1/2. This characteristic may be useful in situations where two or more natural sections may be roughly similar in terms of shape. By manipulating GEOM1 only one cross-section need be inputed.

TRANSPORT BLOCK DATA CARDS
CARD GROUP 10A

Format	Card Columns	Description	Variable Name	Default Value
		Natural Sections[a] Input if N CHANNEL = 1 or 2 (card 1)		None
2I5	1-5	Number of coordinate points (25 max.)		None
	6-10	Number of area increments (50 max.)		None
2F10.2	11-20	X value of left overbank		None
	21-30	X value of right overbank		None
4A4	41-56	Name		None

---

[a] Must include depth of channel (GEOM1) on card 15

TRANSPORT BLOCK DATA CARDS

CARD GROUP 10B

Format	Card Columns	Description	Variable Name	Default Value
		Natural Section Coordinate Point		
10F8.2	1-8	X(1)		None
	9-16	Y(1)		None
	17-24	X(2)		None
	25-32	X(2)		None
		.		
		.		
		X(n)		
		Y(n)		

TRANSPORT BLOCK DATA CARDS
CARD GROUP 10C

Format	Card Columns	Description	Variable Name	Default Value
		Hydraulic Parameters for Natural Section		
3F8.2	1-8	Manning's n of left overbank		None
	9-16	Manning's n of channel		None
	17-24	Manning's n of right overbank		None

TRANSPORT BLOCK DATA CARDS
CARD GROUP 10D

Format	Card Columns	Description	Variable Name	Default Value
		Blank card signifies end of natural sections input		

TRANSPORT BLOCK DATA CARDS

CARD GROUP 11

Format	Card Columns	Description	Variable Name	Default Value
20A4		Title card containing a one-line heading to be printed above output.	TITLE	Blanks

TRANSPORT BLOCK DATA CARDS
CARD GROUP 12

Format	Card Columns	Description	Variable Name	Default Value
		Execution control data.		
16I5	3-5	Total number of sewer elements (maximum = 160).	NE	None
	8-10	Total number of time-steps (maximum = 150).[a]	NDT	None
	14-15	Total number of non-conduit elements into which there will be input hydrographs and pollutographs (maximum = 70, minimum = 1).[a]	NINPUT	None
	19-20	Total number of non-conduit elements at which input hydrographs and pollutographs are to be printed out (maximum = 20, minimum = 1). Go to card 29.	NNYN	None
	24-25	Total number of non-conduit elements at which routed hydrographs and pollutographs are to be printed out (maximum = 20, minimum = 1). Go to card 30.	NNPE	None
	30	Total number of non-conduit elements at which flow is to be transferred to a subsequent block by tape or disk (maximum = 5, minimum = 1).[b] Go to card 27.	NOUTS	None
	35	Control parameter for program-generated error messages occurring in the execution of the flow routing scheme. These errors do not normally affect the program execution.	NPRINT	0

TRANSPORT BLOCK DATA CARDS

CARD GROUP 12 (contd.)

Format	Card Columns	Description	Variable Name	Default Value
		NPRINT = 0 to suppress messages NPRINT = 1 to print messages from ROUTE, NPRINT = 2 to print messages from ROUTE and TRANS.		
	40	Total number of pollutants being routed (maximum = 4, minimum = 0, program will route flows only and all quality operations will be by-passed.	NPOLL	0
	45	Total number of interations to be used in routing subroutine (4 recommended).	NITER	4

---

[a] not required if input is from tape or disk

[b] These are the only points that can be plotted by subroutine GRAPH after being routed by TRANSPORT.

[c] The three pollutants ordinarily routed are BOD, SS and coliforms. A fourth conservative pollutant may be routed if provided for on input tapes, but internal storage should not be used in this case. Not required if input is from tape or disk.

TRANSPORT BLOCK DATA CARDS
CARD GROUP 13

Format	Card Columns	Description	Variable Name	Default Value
		Execution control data.		
8F10.5	1-10	Size of time-step for computation, sec.[a] 10 min. = 600 sec.	DT	None
	11-20	Allowable error for convergence of iterative methods in routing routine (0.0001 recommeded).	EPSIL	0.0001
	21-30	Total number of days (dry weather days) prior to simulation during which solids were not flushed from the sewers. From subroutine DWLOAD.	DWDAYS	0

---

[a] not required if input is from tape or disk

TRANSPORT BLOCK DATA CARDS

CARD GROUP 14

Format	Card Columns	Description	Variable Name	Default Value
		Execution control data.		
16I5	5	Control parameter specifying means to be used to transferring inlet hydrographs, i.e.,	NCNTRL	0
		NCNTRL = 0, normal transfer by tape or disk,		
		NCNTRL = 1, input from cards, utilizing card groups 28, 46, 47.		
	10	Control parameter in estimating groundwater infiltration inflows, i.e.,	NINFIL	0
		NINFIL = 0, infiltration not estimated (INFIL not called and corresponding data omitted).		
		NINFIL = 1, infiltration to be estimated (subroutine INFIL called).		
	15	Control parameter in estimating sanitary sewage inflow, i.e.,	NFILTH	0
		NFILTH = 0, sewage inflows not estimated (FILTH not called and corresponding data omitted),		
		NFILTH = 1, sewage inflows to be estimated (subroutine FILTH called).		
	20	Control parameter concerning printed output, i.e.,	JPRINT	0
		JPRINT = 0, flows and concentration not printed,		

TRANSPORT BLOCK DATA CARDS
CARD GROUP 14 (contd.)

Format	Card Columns	Description	Variable Name	Default Value
		JPRINT = 1, flows and concentrations printed out in tabular form.		
	25	Control parameter concerning plotting of output, JPLOT = 0, plotting routine not called from within TRANSPORT, JPLOT = 1, plotting routine is called from within TRANSPORT.[a]	JPLOT	0
	30	Control parameter for hydraulic design routine i.e., NDESN = 0, hydraulic design routine is not called, NDESN = 1, hydraulic design routing is to be called.	NDESN	0

---

[a] not operational

TRANSPORT BLOCK DATA CARDS

CARD GROUP 15

Format	Card Columns	Description	Variable Name	Default Value
		REPEAT CARD GROUP 15 FOR EACH NUMBERED SEWER ELEMENT (maximum number of cards = 160). THESE CARDS MAY BE READ IN ANY ORDER.		
		Sewer element data.		
5I4	1-4	External element number.[a] No element may be labeled with a number greater than 1000, and it must be a positive numeral.	NOE	None
		However, numbering need not be consecutive or continuous.		
	*******	EXTERNAL NUMBER(S) OF UP-STREAM ELEMENT(S). UP TO THREE ARE ALLOWED. A ZERO DENOTES NO UPSTREAM ELEMENT (maximum value = 1000).	*******	
	5-8	First of three possible upstream elements.	NUE(1)	None
	9-12	Second of three possible upstream elements.	NUE(2)	None
	13-16	Third of three possible elements.	NUE(3)	None
	17-20	Classification of element type. Obtain value from Table 6-1.	NTYPE	None
	*******	THE FOLLOWING VARIABLES ARE DEFINED BELOW FOR CONDUITS ONLY. REFER TO TABLE 6-1 FOR REQUIRED INPUT FOR NON-CONDUITS.	*******	
7F8.3	21-28	Element length for conduit, ft.	DIST.	None

TRANSPORT BLOCK DATA CARDS

CARD GROUP 15 (contd.)

Format	Card Columns	Description	Variable Name	Default Value
	29-36	First characteristic dimension of conduit, ft. See Figure 6-4 and Table 6-2 for definition. If NCHANNEL = 1.0 must include depth of natural section in feet. This is the only natural section characteristic that is required on this card (GEOM2 and GEOM3 = 0.0).	GEOM1	None
	37-44	Invert slope of conduit, ft/100 ft.	SLOPE	0.1
	45-52	Manning's roughness of conduit.	ROUGH	0.013
	53-60	Second characteristic dimension of conduit, ft. See Figure 6-4 and Table 6-2 for definition. (Not required for some conduit shapes).	GEOM2	None
	61-68	Number of barrels[b] for this element. The barrels are assumed to be identical in shape and flow characteristics. (Must be integer ≥ 1.)	BARREL	1.0
	69-76	Third characteristic dimension of conduit, ft. See Figure 6-4 and Table 6-2 for definition. (Not required for some conduit shapes.)	GEOM3	

---

[a] "External" numbers are those assigned by the user to the various sewer system components. "Internal" numbers are assigned within the program. All input to the Transport Model is in terms of external numbers.

[b] Example: A two barrelled conduit would consist of two identical parallel conduits adjacent to each other.

CARD GROUPS 16 THRU 26 MAY BE DELETED IF
INTERNAL STORAGE IS NOT REQUIRED........

TRANSPORT BLOCK DATA CARDS
CARD GROUP 16

Format	Card Columns	Description	Variable Name	Default Value
		CARDS 16 THROUGH 26 ARE DATA INPUT FOR INTERNAL STORAGE. (NTYPE = OMIT THESE DATA CARDS IF INTERNAL IS NOT DESIRED.		
		REPEAT STORAGE MODEL DATA FOR EACH STORAGE ELEMENT (maximum = 2).		
		Storage unit data card.		
10I5	1-5	Storage mode parameter.[a]	ISTMOD	1
		= 1 in-line storage.		
	6-10	Storage type parameter.	ISTTYP	1
		= 1 irregular (natural) reservoir,		
		= 3 geometric (regular) uncovered reservoir.		
	11-15	Storage outlet control parameter.	ISTOUT	1
		= 1 gravity with orifice center line at zero storage tank depth,		
		= 6 existing fixed-rate pumps,		
		= 9 gravity with both weir and orifice.		

[a] must be set equal to one since other storage mode parameters are not programmed.

TRANSPORT BLOCK DATA CARDS
CARD GROUP 17

Format	Card Columns	Description	Variable Name	Default Value
		Computation/print control card.		
3I10	1-10	Pollutant parameter.	IPOL.	0
		= 0 no pollutants (hydraulics only),		
		= 1 perfect plug flow through basin,		
		= 2 perfect mixing in basin.		
	11-20	Print control parameter.	IPRINT	0
		= 0 no print each time-step,		
		= print each time-step in storage.		
	21-30	Cost computation parameter	ICOST	0
		= 0 no cost computations.		
		= 1 costs to be computed.		

TRANSPORT BLOCK DATA CARDS
CARD GROUP 18

Format	Card Columns	Description	Variable Name	Default Value
		Reservoir flood depth data card.		
F10.2	1-10	Maximum (flooding) reservoir depth, ft.	DEPMAX	None

TRANSPORT BLOCK DATA CARDS

CARD GROUP 19

Format	Card Columns	Description	Variable Name	Default Value
		INCLUDE EITHER CARD GROUP 19 OR 20, NOT BOTH.		
		INCLUDE CARD GROUP 19 ONLY IF ISTYP ON CARD 16 HAS THE VALUE L.		
		Reservoir depth-area data card.		
F10.2	1-10	A reservoir water depth, ft.	ADEPTH(1)	None
F10.0	11-20	Reservoir surface area corresponding to above depth, ft.^{2}	AASURF(2)	None
.			.	
. .		.	.	
.		.	.	
F10.2	61-70	A reservoir water depth, ft.	ADEPTH(4)	None
F10.0	71-80	Reservoir surface area corresponding to above depth, ft.^{2}	AASURF(4)	None
		(NOTE: The above pair of variables is repeated 11 times, 4 pairs per card.)		

TRANSPORT BLOCK DATA CARDS
CARD GROUP 20

Format	Card Columns	Description	Variable Name	Default Value
		INCLUDE CARD 20 ONLY IF ISTYP ON CARD 16 HAS THE VALUE 3.		
		Reservoir dimensions data card. Reservoir has shape of inverted truncated cone.		
2F10.0	1-10	Reservoir base area, ft^2.	BASEA	None
	11-20	Reservoir base circumference, ft.	BASEA	None
F10.5	21-30	Cotan of sidespole (horizontal/vertical).	COTSLO	None

TRANSPORT BLOCK DATA CARDS

CARD GROUP 21

Format	Card Columns	Description	Variable Name	Default Value
		INCLUDE ONLY ONE OF THE OUTLET DATA CARDS 21, 22, 23 or 24		
		INCLUDE CARD 21 ONLY IF ISTOUT ON CARD 16 HAS THE VALUE 1.		
		Orifice outlet data card.		
F10.3	1-10	Orifice outlet area x discharge coefficient, ft^2.	CDAOUT	None

TRANSPORT BLOCK DATA CARDS

CARD GROUP 22

Format	Card Columns	Description	Variable Name	Default Value
		INCLUDE CARD 22 ONLY IF ISTOUT ON CARD 16 HAS THE VALUE 2.		
		Weir outlet data card.		
2F10.3	1-10	Weir height (ft) above depth = 0	WEIRHT	None
	11-20	Weir length, ft.	WEIRL	None

TRANSPORT BLOCK DATA CARDS

CARD GROUP 23

Format	Card Columns	Description	Variable Name	Default Value
		INCLUDE CARD 23 ONLY IF ISTOUT ON CARD 16 HAS THE VALUE 6.		
		Pump outlet data card.		
3F10.3	1-10	Outflow pumping rate, cfs.	QPUMP	None
	11-20	Depth (ft) at pump startup.	DSTART	None
	21-30	Depth (ft) at pump shutdown (SDTOP>0.0).[a]		

---

[a] DSTOP must equal or be greater than the level in storage that contains enough volume to handle the pumping rate, QPUMP, for one time-step.

TRANSPORT BLOCK DATA CARDS

CARD GROUP 24

Format	Card Columns	Description	Variable Name	Default Value
		INCLUDE CARD 24 ONLY IF ISTOUT HAS THE VALUE 9.		
8F10.5	1-10	Weir height above depth = 0, ft.	WEIRHT	None
	11-20	Weir length, ft.	WEIRL	None
	21-30	Orifice outlet area x discharge coefficient, ft^2.	CDAOUT	None
	31-40	Orifice centerline elevation above zero depth, ft.	ORIFHT	None

TRANSPORT BLOCK DATA CARDS
CARD GROUP 25

Format	Card Columns	Description	Variable Name	Default Value
		Initial conditions data card.		
2F10.2	1-10	Storage (ft^3) at time zero.	STORO	None
	11-20	Outflow rate (cfs.) at time zero.	QOUTO	None

TRANSPORT BLOCK DATA CARDS
CARD GROUP 26

Format	Card Columns	Description	Variable Name	Default Value
		CARD 26 MUST BE INCLUDED: IT MAY BE BLANK IF ICOST ON CARD 17 HAS THE VALUE 0.		
		Cost data card.		
F10.2	1-10	\$/yard^3 for storage excavation	CPCUYD	None
2F10.2	11-20	\$/acre for storage land.	CPACRE	None
	21-30	\$/pump station with related structures.	CPS	None

TRANSPORT BLOCK DATA CARDS

CARD GROUP 27

Format	Card Columns	Description	Variable Name	Default Value
		List of external non-conduit element numbers at which outflows are to be transferred to subsequent blocks for a total of NOUTS (card 12) non-conduit elements. Go to card 12.	JN	
16I5	1-5	First element number.[a]	JN(1)	None
	6-10	Second element number.[a]	JN(2)	None
	.			
	.			
	.			
	.	Last element number.[a]	JN(NOUTS)	None

---

[a] Element numbers transferred to subsequent blocks must be numbered less than or equal to 100.

TRANSPORT BLOCK DATA CARDS

CARD GROUP 28

Format	Card Columns	Description	Variable Name	Default Value
		IF NCNTRL = 0 ON CARD 14, SKIP TO CARD GROUP 29. Non-conduit element numbers into which hydrographs and pollutographs (from card input) enter the sewer system. These must be in the order in which hydrograph and pollutograph ordinates appear at each time step.		
16I5	1-5	First element number.	NORDER(1)	None
	6-10	Second element number.	NORDER(2)	None
	.			
	.			
	.			
	.	Last element number.	NORDER(NINPUT)	None

TRANSPORT BLOCK DATA CARDS
CARD GROUP 29

Format	Card Columns	Description	Variable Name	Default Value
		List of external non-conduit element numbers at which input hydrographs and pollutographs are to be stored and printed out for a total of NNYN (card 12) non-conduit elements.[a]	NYN	
16I5	1-5	First input location number.	NYN(1)	None
	6-10	Second input location number.	NYN(2)	None
	.			
	.			
	.			
	.	Last input location number	NYN(NNYN)	None

---

[a] from runoff block

TRANSPORT BLOCK DATA CARDS

CARD GROUP 30

Format	Card Columns	Description	Variable Name	Default Value
		List of external non-conduit element numbers at which output hydrographs and pollutographs are to be stored and printed out for a total of NNPE (card 12) non-conduit elements.[a]	NPE	
16I5	1-5	First output location number.	NPE(1)	None
	6-10	Second output location number.	NPE(2)	None
	.		.	
	.		.	
	.	Last output location number.	NPE(NNPE)	None

---

[a] computed in TRANSPORT block from routed input hydrographs

CARD GROUPS 31 THRU 33 MAY BE DELETED IF SUBROUTINE INFIL IS NOT CALLED...........

TRANSPORT BLOCK DATA CARDS

CARD GROUP 31

Format	Card Columns	Description	Variable Name	Default Value
		IF SUBROUTINE INFIL IS TO BE CALLED (NNFIL = L), INSERT CARDS 31 THROUGH 33 OTHERWISE OMIT.		
		Estimated infiltration.		
10F8.1	1-8	Base dry weather infiltration, gal/min.	DINFIL	0.0
	9-16	Groundwater infiltration, gal/min.	GINFIL	0.0
	17-24	Rainwater infiltration, gal/min.	RINFIL	0.0

TRANSPORT BLOCK DATA CARDS
CARD GROUP 32

Format	Card Columns	Description	Variable Name	Default Value
		Control parameters,		
I5	3-5	Day of year of estimate.[a]	NDYUD	None
6F8.1	6-13	Peak residual moisture, gal/min.	RSMAX	.0.0
	14-21	Average distance between joints, ft.	ULEN	6.0

---

[a] day one is July 15

TRANSPORT BLOCK DATA CARDS
CARD GROUP 33

Format	Card Columns	Description	Variable Name	Default Value
		Monthly degree-days.[b]	NDD	
16I5	1-5	July degree-days.	NDD(1)	None
	6-10	August degree-days	NDD(2)	None
	.		.	.
	.		.	.
	.		.	.
	56-60	June degree-days	NDD(12)	None

---

[b] see Table A-1 for values at selected locations.

CARD GROUPS 34 THRU 45 MAY BE DELETED IF SUBROUTINE FILTH IS NOT CALLED..........

TRANSPORT BLOCK DATA CARDS

CARD GROUP 34

Format	Card Columns	Description	Variable Name	Default Value
		IF SUBROUTINE FILTH IS TO BE CALLED (INFILTH = 1), INSERT CARD GROUPS 34 THROUGH 45, OTHERWISE OMIT.		
		Factors to correct yearly average sewage flows to daily average by accounting for daily variations throughout a typical week.		
7F10.0	1-10	Flow correction for Sunday.	DVDWF(1)	1.0
	11-20	Flow correction for Monday.	DVDWF(2)	1.0
	.		.	
	.	.	.	
	.	.	.	
	.		.	
	61-70	Flow correction for Sunday.	DVDWF(7)	1.0

TRANSPORT BLOCK DATA CARDS
CARD GROUP 35

Format	Card Columns	Description	Variable Name	Default Value
		IF NPOLL = 0 SKIP TO CARD GROUP 37		
		Factors to correct BOD yearly averages to daily averages.		
7F10.0	1-10	BOD correction for Sunday.	DVBOD(1)	1.0
	.		.	.
	.			.
	.			.
	.			.
	61-70	BOD correction for Saturday.	DVBOD(7)	1.0

TRANSPORT BLOCK DATA CARDS

CARD GROUP 36

Format	Card Columns	Description	Variable Name	Default Value
		Factors for correction of yearly SS averages to daily averages.		
7F10.0	1-10	SS correction for Sunday.	DVSS	1.0
	.			.
	.			.
	.			.
	.			.
	61-70	SS correction for Saturday.	DVSS(7)	1.0

TRANSPORT BLOCK DATA CARDS

CARD GROUP 37

Format	Card Columns	Description	Variable Name	Default Value
		Factors to correct daily average sewage flow to hourly averages by accounting for hourly variations throughout a typical day (3 cards needed).		
8F10.0	1-10	Midnight to 1 a.m. factor (first card).	HVDWF(1)	1.0
	.			.
	.			.
	.			.
	.			.
	1-10	8 a.m. to 9 a.m. factor (second card).	HVDWF(9)	1.0
	.			.
	.			.
	.			.
	1-10	4 p.m. to 5 p.m. factor (third card).	HVDWF(17)	1.0

TRANSPORT BLOCK DATA CARDS

CARD GROUP 38

Format	Card Columns	Description	Variable Name	Default Value
		IF NPOLL = 0 SKIP TO CARD GROUP 41		
		Factors for BOD hourly corrections (3 cards needed).		
8F10.0	1-10	Midnight to 1 a.m. factor (first card).	HVBOD(1)	1.0
	.			.
	.			.
	.			.
	71-80	11 a.m. to midnight factor (third card).	HVBOD(24)	1.0

TRANSPORT BLOCK DATA CARDS

CARD GROUP 39

Format	Card Columns	Description	Variable Name	Default Value
		Factors for SS hourly corrections (3 cards needed).		
8F10.0	1-10	Midnight to 1 a.m. factor (first card).	HVSS(1)	1.0
	.			.
	.			.
	.			.
	.			.
	71-80	11 a.m. to midnight factor (third card).	HVSS(24)	1.0

TRANSPORT BLOCK DATA CARDS

CARD GROUP 40

Format	Card Columns	Description	Variable Name	Default Value
		INCLUDE ONLY WHEN 3 POLLUTANTS ARE SPECIFIED.		
		Factors for E. coli hourly corrections (3 cards needed).		
8F10.0	1-10	Midnight to 1 a.m. factor (first card).	HVCOLI(1)	1.0
	.			.
	.			.
	.			.
	.			.
	71-80	11 a.m. to midnight factor (third card).	HVCOLI(24)	1.0

TRANSPORT BLOCK DATA CARDS
CARD GROUP 41

Format	Card Columns	Description	Variable Name	Default Value
		Study area data,		
6I5	1-5	Total number of subareas within a given study area in which sewage flow and quality are to estimated,	KTNUM	None
	6-10	Indicator as to whether study area data, such as treatment plant records, are to be used to estimate sewage quality, i.e., KASE = 1, yes, KASE = 2, no.	KASE	None
	11-15	Total number of process ffows within the study area for which data are included in one of the following card groups	NPF	0
	16-20	Number indicating the day of the week during which simulation begins (Sunday = 1).	KDAY	1
	21-25	Number indicating the hour of the day during which simulation begins (1 a.m. = 1).	KHOUR	0
	26-30	Number indicating the minute of the hour during which simulation begins	KMINS	0
2F5.1	31-35	Consumer Price Index.	CPI	109.5
	36-40	Composite Construction Cost Index.	CCCI	103.0
F10.3	41-50	Total polulation in all areas, thousands.	POPULA	None

TRANSPORT BLOCK DATA CARDS

CARD GROUP 42

Format	Card Columns	Description	Variable Name	Default Value
		IF KASE = 1, INCLUDE CARD GROUPS 42,43 &44.		
42		Average study area data.		
3F10.0	1-10	Total study area average sewage flow, i.e., from treatment plant records, cfs.[a]	ADWF	0.0
	11-20	Total study area average BOD, mg/l.	ABOD	0.0
	21-30	Total study area average SS, mg/l.	ASUSO	0.0
E10.2	31-40	Total coliforms, MPN/100 ml.	ACOCI	0.0

TRANSPORT BLOCK DATA CARDS

CARD GROUP 43

Format	Card Columns	Description	Variable Name	Default Value
		Categorized study area data.		
8F8.0	1-8	Total study area from which ABOD and ASUSO were taken, acres,	TOTA	None
	9-16	Total contributing industrial area, acres.	TINA	None
	17-24	Total contributing commercial area, acres.	TCA	None
	25-32	Total contributing high income (above $15,000) residential area, acres.	TRHA	None
	33-40	Total contributing average income (above $7,000 but below $15,000) residential area, acres.	TRAA	None
	41-48	Total contributing low income (below $4,000) residential area, acres.	TRLA	None
	49-56	Total area from the above three residential areas that contribute additional waste from garbage graינders, acres.	TRGGA	None
	57-64	Total park and open area within the study area, acres	TPOA	None

TRANSPORT BLOCK DATA CARDS
CARD GROUP 44

Format	Card Columns	Description	Variable Name	Default Value
		IF PROCESS FLOW DATA ARE AVAILABLE (NPF NOT EQUAL 0 AND KASE = 1), REPEAT CARD GROUP 44 FOR EACH PROCESS FLOW. OTHERWISE, SKIP TO CARD GROUP 45.		
		Process flow characteristics.		
I5	1-5	External manhole number into which flow is assumed to enter (maximum value = 1000, minimum value = 1).	INPUT	None
6F10.3	6-15	Average daily process flow entering the study area system, cfs.	QPF	None
	16-25	Average daily BOD of process flow, mg/l.	BODPF	0.0
	26-35	Average daily SS of process flow, mg/l.	SUSPF	0.0

TRANSPORT BLOCK DATA CARDS

CARD GROUP 45

Format	Card Columns	Description	Variable Name	Default Value
		REPEAT CARD GROUP 45 FOR EACH OF THE KTNUM SUBAREAS. THESE SUBAREAS DO NOT NECESSARILY HAVE TO CORRESPOND TO RUNOFF SUBCATCHMENTS.		
		Subarea data.		
2I3	1-3	Subarea number.	KNUM	None
	4-6	External number of the manhole into which flow is assumed to enter for subarea KNUM (maximum value = 1000, minimum value = 1	INPUT	None
3I1	7	Predominant land use within subarea, i.e., KLAND = 1, Single-family residential, KLAND = 2, Multi-family residential, KLAND = 3, Commercial, KLAND = 4, Industrial, KLAND = 5, Undeveloped or park lands.	KLAND	5
	8	Parameter indicating whether or not water usage within subarea KNUM is metered. METHOD = 1, metered water use, METHOD = 2, incomplete or no metering.	METHOD	2
	9	Parameter indicating units in which water usage estimates (WATER) are tabulated.	KUNIT	0

CARD GROUP 45 (contd)

Format	Card Columns	Description	Variable Name	Default Value
		KUNIT= 0, thousand gal/mo, KUNIT = 1, thousand ft^3/mo.		
13F5.1	10-14	Measured winter water use for subarea KNUM in the units specified by KUNIT (not required).	WATER	None
	15-19	Cost of the last thousand gal. of water per billing period for an average consumer within subarea KNUM, cents/1,000 gal. (not required).	PRICE	None
	20-24	Measured average sewage low from the entire subarea KNUM, cfs (not required).	SEWAGE	None
	25-29	Total area within subarea KNUM, acres (maximum = 200).	ASUB	None

APPENDIX C

TABLE A.1. STORM DATA SUMMARY

STATION H-20
3-26,27-74

Starting Time of Storm	1025
Total Duration of Storm, min.	1415
Total Drainage Area, ac.	1976.8
No. of Dry Days Prior to Storm	
Total Rainfall, in.	
Peak Discharge, cfs.	40
Total Runoff, cu.ft.	1,831,950

Pollutant	Total lbs.	lbs./ac.	lbs./ac.-in.
Suspended solids	22,483.39	11.375	44.
BOD	2,408.55	1.2184	0.088
Total COD	11,379.28	5.7564	22.1
Soluble COD			
Ammonia	286.68	.1450	0.56
Nitrate	58.09	$2.939X10^{-2}$	0.113
Nitrite	7.42	$3.754X10^{-3}$	0.014
Kjeldahl nitrogen	401.38	.2030	0.78
Phosphate			

TABLE A.2. STORM DATA SUMMARY

STATION H-20
4-11,12-74

Starting Time of Storm	1210
Total Duration of Storm, min.	1250
Total Drainage Area, ac.	1976.8
No. of Dry Days Prior to Storm	
Total Rainfall, in.	
Peak Discharge, cfs.	11
Total Runoff, cu.ft.	540,720

Pollutant	Total lbs.	lbs./ac.	lbs./ac.-in.
Suspended solids	4099.46	2.074	28
BOD			
Total COD	3426.11	1.733	23
Soluble COD	1075.26	.544	7.2
Ammonia	24.65	1.247×10^{-2}	0.17
Nitrate	11.38	5.757×10^{-3}	0.076
Nitrite	2.18	1.103×10^{-3}	0.015
Kjeldahl nitrogen	52.52	2.657×10^{-2}	0.353
Phosphate			

TABLE A.3. STORM DATA SUMMARY

STATION H-20
5-8,9-75

Starting Time of Storm	2110
Total Duration of Storm, min.	850
Total Drainage Area, ac.	1976.8
No. of Dry Days Prior to Storm	1
Total Rainfall, in.	.81
Peak Discharge, cfs.	73
Total Runoff, cu.ft.	1,258,866.

Pollutant	Total lbs.	lbs./ac.	lbs./ac.-in.
Suspended solids	16,197.00	8.194	46.72
BOD			
Total COD	14,043.86	7.104	40.50
Soluble COD	2,749.32	1.3908	7.929
Ammonia	94.37	.0477	.2719
Nitrate	40.06	.0203	.1157
Nitrite	4.52	.0023	.0131
Kjeldahl nitrogen	254.69	.1288	.7343
Phosphate			

TABLE A.4. STORM DATA SUMMARY

STATION H-20
6-30-75

Starting Time of Storm	1733
Total Duration of Storm, min.	1122
Total Drainage Area, ac.	1976.8
No. of Dry Days Prior to Storm	2
Total Rainfall, in.	1.85
Peak Discharge, cfs.	135
Total Runoff, cu.ft.	5,039,232.

Pollutant	Total lbs.	lbs./ac.	lbs./ac.-in.
Suspended solids	56,997.66	28.83	41.07
BOD			
Total COD	25,238.97	12.77	18.19
Soluble COD	6,122.91	3.097	4.412
Ammonia	659.85	.3338	.4755
Nitrate	116.96	.0592	.0843
Nitrite	13.96	.0071	.0101
Kjeldahl nitrogen	1,237.34	.6258	.8915
Phosphate	403.43	.2041	.2907

TABLE A.5. STORM DATA SUMMARY

STATION P-10
12-5-74

Starting Time of Storm	2000
Total Duration of Storm, min.	5055
Total Drainage Area, ac.	16,050.3
No. of Dry Days Prior to Storm	11
Total Rainfall, in.	1.47
Peak Discharge, cfs.	277
Total Runoff, cu.ft.	37,534,873.

Pollutant	Total lbs.	lbs./ac.	lbs./ac.-in.
Suspended solids	62,040.13	3.89	6.00
BOD			
Total COD	144,148.94	8.981	13.95
Soluble COD	102,278.41	6.372	9.895
Ammonia	202.54	1.26 E-2	.0196
Nitrate	27.73	1.73 E-3	.0027
Nitrite			
Kjeldahl nitrogen	1,929.22	1.20 E-1	.1866
Phosphate			

TABLE A.6. STORM DATA SUMMARY

STATION P-10
3-13-75

Starting Time of Storm	0500
Total Duration of Storm, min.	1190
Total Drainage Area, ac.	16,050.3
No. of Dry Days Prior to Storm	10
Total Rainfall, in.	.81
Peak Discharge, cfs.	56
Total Runoff, cu.ft.	2,557,680

Pollutant	Total lbs.	lbs./ac.	lbs./ac.-in.
Suspended solids	13,089.06	8.15 E-1	18.523
BOD			
Total COD	10,745.25	6.69 E-1	15.204
Soluble COD	8,483.26	5.28 E-1	12.00
Ammonia	16.99	1.06 E-3	.0241
Nitrate	18.58	1.16 E-3	.0264
Nitrite	.57	3.55 E-5	.0008
Kjeldahl nitrogen	286.78	1.79 E-2	.4068
Phosphate	17.86	1.11 E-3	.0252

TABLE A.7. STORM DATA SUMMARY

STATION P-10
4-7-75

Starting Time of Storm	0400
Total Duration of Storm, min.	3350
Total Drainage Area, ac.	16,050.3
No. of Dry Days Prior to Storm	7
Total Rainfall, in.	2.45
Peak Discharge, cfs.	1165
Total Runoff, cu.ft.	73,088,676.

Pollutant	Total lbs.	lbs./ac.	lbs./ac.-in.
Suspended solids	169,234.86	10.54	8.402
BOD			
Total COD	257,826.	16.06	12.802
Soluble COD	191,635.9	11.94	9.518
Ammonia	341.24	2.13 E-2	.0170
Nitrate	288.76	1.80 E-3	.0014
Nitrite	17.32	1.08 E-3	.0009
Kjeldahl nitrogen	6.061.75	3.78 E-1	.3013
Phosphate			

TABLE A.8. STORM DATA SUMMARY

STATION P-30
1-18-74

Starting Time of Storm	2345
Total Duration of Storm, min.	5385
Total Drainage Area, ac.	21,606.7
No. of Dry Days Prior to Storm	7
Total Rainfall, in.	2.05
Peak Discharge, cfs.	1260
Total Runoff, cu.ft.	108,637.695

Pollutant	Total lbs.	lbs./ac.	lbs./ac.-in.
Suspended solids	1,514,697.33	70.10	50
BOD			
Total COD			
Soluble COD			
Ammonia	232.70	$1.08X10^{-2}$	0.0078
Nitrate	194.46	$9.00X10^{-3}$	0.0065
Nitrite			
Kjeldahl nitrogen			
Phosphate			

TABLE A.9. STORM DATA SUMMARY

STATION P-30

10-28-74

Starting Time of Storm	0515
Total Duration of Storm, min.	4380
Total Drainage Area, ac.	21,606.7
No. of Dry Days Prior to Storm	13
Total Rainfall, in.	3.48
Peak Discharge, cfs.	380
Total Runoff, cu.ft.	41,665,965.

Pollutant	Total lbs.	lbs./ac.	lbs./ac.-in.
Suspended solids	779,590.	36.081	67.949
BOD			
Total COD			
Soluble COD			
Ammonia	243.23	.0113	.0212
Nitrate	94.63	.0044	.0082
Nitrite			
Kjeldahl nitrogen			
Phosphate	260.60	.0121	.0227

TABLE A.10. STORM DATA SUMMARY

STATION P-30
12-5-74

Starting Time of Storm	2000
Total Duration of Storm, min.	4680
Total Drainage Area, ac.	21,606.7
No. of Dry Days Prior to Storm	11
Total Rainfall, in.	1.53
Peak Discharge, cfs.	305
Total Runoff, cu.ft.	54,618,420.

Pollutant	Total lbs.	lbs./ac.	lbs./ac.-in.
Suspended solids	295,184.66	13.66	19.629
BOD			
Total COD	194,368.38	8.996	12.925
Soluble COD	138,747.99	6.422	9.226
Ammonia	351.88	1.63 E-2	.0234
Nitrate	80.64	3.73 E-3	.0054
Nitrite	18.36	8.50 E-4	.0012
Kjeldahl nitrogen	3,082.4	1.43 E-1	.2049
Phosphate	341.04	1.58 E-2	.0227

TABLE A.11. STORM DATA SUMMARY

STATION P-30

4-7-75

Starting Time of Storm	0410
Total Duration of Storm, min.	3560
Total Drainage Area, ac.	21,606.7
No. of Dry Days Prior to Storm	7
Total Rainfall, in.	2.77
Peak Discharge, cfs.	1100
Total Runoff, cu.ft.	117,861,600.

Pollutant	Total lbs.	lbs./ac.	lbs./ac.-in.
Suspended solids	1,298,690.13	60.12	40.0
BOD			
Total COD	382,071.83	17.683	11.765
Soluble COD			
Ammonia	1,116.62	5.40 E-3	.0036
Nitrate	1,152.55	5.33 E-2	.0355
Nitrite	90.80	4.20 E-3	.0028
Kjeldahl nitrogen	10,266.53	4.75 E-1	.3162
Phosphate	636.97	2.95 E-2	.0196

TABLE A.12. STORM DATA SUMMARY

STATION D-10

4-8-75

Starting Time of Storm	0400
Total Duration of Storm, min.	3431
Total Drainage Area, ac.	467
No. of Dry Days Prior to Storm	7
Total Rainfall, in.	3.97
Peak Discharge, cfs.	120
Total Runoff, cu.ft.	5.021,760.

Pollutant	Total lbs.	lbs./ac.	lbs./ac.-in.
Suspended solids	35,294.11	75.576	25.51
BOD			
Total COD	17,082.09	36.578	12.348
Soluble COD	9,814.53	21.016	7.095
Ammonia	31.49	.0674	.0228
Nitrate	51.94	.1112	.0375
Nitrite	2.55	.0055	.0019
Kjeldahl nitrogen	538.73	1.1536	.3894
Phosphate			

TABLE A.13. STORM DATA SUMMARY

STATION D-50
3-13-75

Starting Time of Storm	0400
Total Duration of Storm, min.	1185
Total Drainage Area, ac.	575
No. of Dry Days Prior to Storm	10
Total Rainfall, in.	.81
Peak Discharge, cfs.	2.0
Total Runoff, cu.ft.	84,253

Pollutant	Total lbs.	lbs./ac.	lbs./ac.-in.
Suspended solids	781.50	1.359	33.72
BOD			
Total COD	195.59	.3402	8.441
Soluble COD	150.19	.2612	6.481
Ammonia	.64	.0011	.0276
Nitrate	1.05	.0018	.0453
Nitrite	.06	.0001	.0026
Kjeldahl nitrogen	3.16	.0055	.1364
Phosphate	.78	.0014	.0337

TABLE A.14. STORM DATA SUMMARY

STATION D-50
4-8-75

Starting Time of Storm	0440
Total Duration of Storm, min.	3380
Total Drainage Area, ac.	575
No. of Dry Days Prior to Storm	7
Total Rainfall, in.	3.97
Peak Discharge, cfs.	113
Total Runoff, cu.ft.	4,137,147.

Pollutant	Total lbs.	lbs./ac.	lbs./ac.-in.
Suspended solids	62,702.14	109.05	55.02
BOD			
Total COD	10,391.58	18.072	9.118
Soluble COD	6,789.10	11.807	5.957
Ammonia	40.49	.0704	.0355
Nitrate	68.62	.1193	.0602
Nitrite	9.22	.0160	.0081
Kjeldahl nitrogen	338.40	.5885	.2969
Phosphate			

TABLE A.15. STORM DATA SUMMARY

LUBBOCK, TEXAS

9-22-71

Starting Time of Storm	
Total Duration of Storm, min.	315
Total Drainage Area, ac.	223.73
No. of Dry Days Prior to Storm	
Total Rainfall, in.	
Peak Discharge, cfs.	3.96
Total Runoff, cu.ft.	30,726

Pollutant	Total lbs.	lbs./ac.	lbs./ac.-in.
Suspended solids	374.19	1.67	
BOD	9.52	.043	
Total COD	379.23	1.70	
Soluble COD			
Ammonia			
Nitrate	0.16	$7.15X10^{-4}$	
Nitrite			
Kjeldahl nitrogen			
Phosphate	0.12	0.125	

TABLE A.16. STORM DATA SUMMARY

LUBBOCK, TEXAS
10-17-71

Starting Time of Storm	
Total Duration of Storm, min.	170
Total Drainage Area, ac.	223.73
No. of Dry Days Prior to Storm	
Total Rainfall, in.	
Peak Discharge, cfs.	4.58
Total Runoff, cu.ft.	17,310

Pollutant	Total lbs.	lbs./ac.	lbs./ac.-in.
Suspended solids	823.33	3.68	
BOD			
Total COD	914.36	4.09	
Soluble COD			
Ammonia			
Nitrate			
Nitrite	0.12	$5.36X10^{-4}$	
Kjeldahl nitrogen			
Phosphate	.05	$2.23X10^{-4}$	

TABLE A.17. STORM DATA SUMMARY

LUBBOCK, TEXAS
10-25-71

Starting Time of Storm	
Total Duration of Storm, min.	210
Total Drainage Area, ac.	223.73
No. of Dry Days Prior to Storm	
Total Rainfall, in.	
Peak Discharge, cfs.	5.97
Total Runoff, cu.ft.	20,970

Pollutant	Total lbs.	lbs./ac.	lbs./ac.-in.
Suspended solids	659.31	2.95	
BOD	23.13	0.103	
Total COD	521.11	2.33	
Soluble COD			
Ammonia			
Nitrate			
Nitrite	.17	$7.60X10^{-4}$	
Kjeldahl nitrogen			
Phosphate	.07	$3.13X10^{-4}$	

TABLE A.18. STORM DATA SUMMARY

LUBBOCK, TEXAS
5-3-72

Starting Time of Storm	
Total Duration of Storm, min.	270
Total Drainage Area, ac.	223.73
No. of Dry Days Prior to Storm	
Total Rainfall, in.	
Peak Discharge, cfs.	5.94
Total Runoff, cu.ft.	19,422

Pollutant	Total lbs.	lbs./ac.	lbs./ac.-in.
Suspended solids	9533.19	42.61	
BOD	133.84	0.60	
Total COD	890.14	3.98	
Soluble COD			
Ammonia			
Nitrate			
Nitrite	0.52	$2.32\text{X}10^{-3}$	
Kjeldahl nitrogen			
Phosphate	0.06	$2.68\text{X}10^{-4}$	

TABLE A.19. STORM DATA SUMMARY

LUBBOCK, TEXAS
5-4-72

Starting Time of Storm	
Total Duration of Storm, min.	105
Total Drainage Area, ac.	223.73
No. of Dry Days Prior to Storm	0
Total Rainfall, in.	
Peak Discharge, cfs.	1.9
Total Runoff, cu.ft.	4,995

Pollutant	Total lbs.	lbs./ac.	lbs./ac.-in.
Suspended solids	599.66	2.68	
BOD			
Total COD	79.68	0.356	
Soluble COD			
Ammonia			
Nitrate			
Nitrite	.07	$3.13\text{X}10^{-4}$	
Kjeldahl nitrogen			
Phosphate	.05	$2.23\text{X}10^{-4}$	

TABLE A.20. STORM DATA SUMMARY

LUBBOCK, TEXAS
5-5-72

Starting Time of Storm	
Total Duration of Storm, min.	360
Total Drainage Area, ac.	223.73
No. of Dry Days Prior to Storm	0
Total Rainfall, in.	
Peak Discharge, cfs.	6.93
Total Runoff, cu.ft.	47,448

Pollutant	Total lbs.	lbs./ac.	lbs./ac.-in.
Suspended solids	6630.5	-	
BOD	101.08	0.452	
Total COD	940.89	4.21	
Soluble COD			
Ammonia			
Nitrate			
Nitrite	.68	$3.04X10^{-3}$	
Kjeldahl nitrogen			
Phosphate	.45	$2.01X10^{-3}$	

TABLE A.21. STORM DATA SUMMARY

LUBBOCK, TEXAS
6-29-72

Starting Time of Storm	
Total Duration of Storm, min.	135
Total Drainage Area, ac.	223.73
No. of Dry Days Prior to Storm	
Total Rainfall, in.	
Peak Discharge, cfs.	4.32
Total Runoff, cu.ft.	14,661

Pollutant	Total lbs.	lbs./ac.	lbs./ac.-in.
Suspended solids	1439.11	6.43	
BOD	22.37	0.10	
Total COD	326.78	1.461	
Soluble COD			
Ammonia			
Nitrate			
Nitrite	.09	$4.02X10^{-4}$	
Kjeldahl nitrogen			
Phosphate	.04	$1.79X10^{-4}$	

TABLE A.22. STORM DATA SUMMARY

LUBBOCK, TEXAS
6-30-72

Starting Time of Storm	
Total Duration of Storm, min.	270
Total Drainage Area, ac.	223.73
No. of Dry Days Prior to Storm	
Total Rainfall, in.	
Peak Discharge, cfs.	3.72
Total Runoff, cu.ft.	17,469

Pollutant	Total lbs.	lbs./ac.	lbs./ac.-in.
Suspended solids	1193.29	5.33	
BOD	17.96	0.08	
Total COD	153.10	0.684	
Soluble COD			
Ammonia			
Nitrate			
Nitrite	0.20	$8.94X10^{-4}$	
Kjeldahl nitrogen			
Phosphate	.18	$8.05X10^{-4}$	

TABLE A.23. STORM DATA SUMMARY

LUBBOCK, TEXAS
7-3-72

Starting Time of Storm	
Total Duration of Storm, min.	210
Total Drainage Area, ac.	223.73
No. of Dry Days Prior to Storm	
Total Rainfall, in.	
Peak Discharge, cfs.	13.97
Total Runoff, cu.ft.	61,110

Pollutant	Total lbs.	lbs./ac.	lbs./ac.-in.
Suspended solids	5868.89	26.23	
BOD			
Total COD			
Soluble COD			
Ammonia			
Nitrate			
Nitrite	.61	$2.73X10^{-3}$	
Kjeldahl nitrogen			
Phosphate	.42	$1.88X10^{-3}$	

TABLE A.24. STORM DATA SUMMARY

LUBBOCK, TEXAS
7-4-72

Starting Time of Storm	
Total Duration of Storm, min.	135
Total Drainage Area, ac.	223.73
No. of Dry Days Prior to Storm	
Total Rainfall, in.	
Peak Discharge, cfs.	13.43
Total Runoff, cu.ft.	54,144

Pollutant	Total lbs.	lbs./ac.	lbs./ac.-in.
Suspended solids	7349.55	32.85	
BOD			
Total COD	558.31	2.50	
Soluble COD			
Ammonia			
Nitrate			
Nitrite	.82	3.67	
Kjeldahl nitrogen			
Phosphate	.33	$1.47X10^{-3}$	

TABLE A.25. STORM DATA SUMMARY

LUBBOCK, TEXAS
8-23-74

Starting Time of Storm	
Total Duration of Storm, min.	360
Total Drainage Area, ac.	223.73
No. of Dry Days Prior to Storm	
Total Rainfall, in.	
Peak Discharge, cfs.	6.67
Total Runoff, cu.ft.	54,552

Pollutant	Total lbs.	lbs./ac.	lbs./ac.-in.
Suspended solids	1145.86	5.12	
BOD			
Total COD	5098.54	22.79	
Soluble COD			
Ammonia			
Nitrate			
Nitrite			
Kjeldahl nitrogen			
Phosphate			

APPENDIX D

TABLE D.1. RECESSION RATE DETERMINATION, STATION P-30

Ln Q		Δ Ln Q	Δt	Slope
From	To			K
6.89	6.19	.70	.4	.44
6.19	5.33	.86	.75	.285
5.33	5.01	.32	.5	.16
5.01	3.72	1.29	.9	.36
3.72	2.96	.76	.9	.21
2.96	2.55	.41	1.75	.06
4.79	4.64	.15	.25	.15
4.64	4.16	.48	.4	.3
4.21	3.73	.48	.5	.24
3.73	3.10	.63	.85	.185
3.10	2.90	.20	.45	.11
2.90	2.42	.48	2.5	.05
2.42	2.35	.07	.95	.002
3.49	3.23	.26	.45	.1445
3.49	3.17	.32	1.0	.08
3.06	1.77	1.29	4.0	.0805
6.42	5.72	.70	.5	.35
5.72	3.76	1.96	1.75	.28
3.76	3.34	.42	.6	.175
3.34	3.17	.17	.5	.085
6.14	4.98	1.16	1.1	.2635
4.98	3.85	1.13	1.15	.2455
3.85	3.57	.28	.45	.1555
5.59	4.60	.99	.9	.275
4.60	3.69	.91	.65	.35
3.69	3.24	.45	.4	.2815
3.24	2.79	.45	.85	.1325
6.31	3.61	2.70	2.25	.3
3.61	3.18	.43	.55	.1955

TABLE D.1. (Cont)

Ln Q From	 To	Δ Ln Q	Δt	Slope K
3.18	2.51	.67	1.5	.115
2.51	2.29	.22	1.1	.05
2.61	1.87	.74	1.5	.1235
1.87	1.48	.39	2.5	.039
3.42	3.08	.34	.15	.5665
3.08	2.71	.37	.5	.185
2.75	1.57	1.18	3.4	.087
1.57	1.36	.21	1.2	.044
3.79	3.32	.47	.4	.294
3.32	2.79	.53	.9	.147
2.79	1.89	.90	1.95	.1155
6.68	5.62	1.06	.6	.4415
5.62	3.93	1.69	1.3	.325
6.68	5.76	.92	.6	.3835
5.76	4.10	1.66	1.75	.237
6.80	6.01	.79	.45	.439
6.01	2.93	3.08	2.2	.35
2.93	.83	2.10	2.55	.206
5.84	4.57	1.27	.85	.3735
4.57	2.79	1.78	.75	.5935
2.79	2.52	.27	.35	.193
5.54	5.03	.51	.5	.255
5.03	3.94	1.09	.6	.454
3.94	2.79	1.15	.65	.338
3.19	2.79	.40	.35	.2855
2.79	2.31	.48	1.25	.096
2.56	2.18	.38	.825	.115
3.73	2.76	.97	2.1	.1155
2.98	2.76	.22	.75	.0735
3.73	2.32	1.41	2.575	.137

TABLE D.1. (Cont)

Ln Q		Δ Ln Q	Δt	Slope K
From	To			
2.32	1.89	.43	2.35	.0455
3.06	2.57	.49	.75	.1635
2.57	2.42	.15	.575	.065
2.42	1.89	.53	1.4	.0945
5.63	3.97	1.66	1.375	.313
3.97	2.76	1.21	1.6	.189
2.76	1.87	.89	1.65	.135
1.87	1.49	.38	1.65	.0575
6.90	5.88	1.02	.65	.3925
7.92	5.95	1.97	.85	.579
5.95	4.23	1.72	1.575	.273
4.23	3.85	.38	.925	.1025
1.71	1.31	.4	1.59	.0325
6.68	5.44	1.24	.665	.466
5.44	3.41	2.03	1.42	.3575
3.41	2.59	.82	1.25	.164
6.89	5.96	.93	.42	.5535
5.96	4.40	1.56	1.275	.332
4.40	3.04	1.36	1.58	.215
3.04	2.02	1.02	1.745	.146
2.02	1.36	.66	1.885	.09
3.55	2.82	.73	.75	.2435
2.82	1.98	.84	1.5	.14
1.98	1.74	.24	.66	.091
4.75	3.86	.89	.65	.3425
3.86	3.19	.67	.755	.222
3.19	2.75	.44	1.235	.089
3.26	3.42	1.84	1.59	.2845
3.42	2.88	.54	1.245	.1085
2.88	1.64	1.24	3.675	.0845
4.02	3.05	.97	.67	.362

TABLE D . 1. (Cont)

Ln Q From	 To	Δ Ln Q	Δ t	Slope K
2.90	2.07	.83	.25	.83
2.07	1.64	.43	.32	.3355
5.13	2.90	2.23	1.74	.3205
2.90	2.31	.59	1.08	.1365
2.31	1.60	.71	2.09	.085
1.60	1.20	.40	2.825	.0355
1.20	.84	.36	.75	.12
5.16	3.08	2.08	1.5	.3465
3.26	2.90	.36	.59	.1525
2.90	2.11	.79	2.165	.91
2.11	1.57	.54	4.5	.03
1.57	1.20	.37	5.25	.0175
1.20	.85	.35	1.49	.0585
3.56	2.72	.84	.25	.84
2.72	1.95	.77	.425	.453
3.10	2.05	1.05	.5	.525
2.05	.81	1.24	2.44	.127
.81	-.04	.85	.815	.2605
8.64	5.96	2.68	.915	.732
5.96	5.18	.78	.75	.26
3.33	3.11	.22	.25	.22
4.02	3.53	.49	.91	.1345
3.72	3.60	.12	.25	.12
3.80	2.71	1.09	2.08	.131

TABLE D.2. RECESSION RATE DETERMINATION
STATION P-10

Ln Q		Δ Ln Q	Δt	Slope K
From	To			
6.67	5.42	1.34	.65	.5155
5.42	3.46	1.96	1.5	.3265
3.46	2.55	.91	1.35	.1685
2.55	2.14	.41	1.75	.0585
4.55	3.75	.80	.35	.5715
3.75	3.37	.38	.35	.2715
4.27	3.40	.87	.75	.29
3.40	3.12	.28	.35	.2
3.12	2.28	.84	2.0	.105
2.25	1.84	.41	1.1	.093
3.12	2.81	.31	.65	.119
3.67	3.44	.23	.25	.23
3.44	3.14	.30	.45	.1665
3.14	3.06	.08	.35	.057
2.77	1.41	1.36	3.6	.0945
6.58	5.61	.97	.5	.485
5.61	3.53	2.08	1.6	.325
3.53	2.80	.73	1.4	.1305
6.12	5.18	.94	.65	.3615
5.18	3.70	1.48	1.25	.296
3.70	3.12	.58	1.15	.126
5.43	3.44	1.99	1.3	.3825
3.44	2.23	1.21	1.85	.1635
6.52	5.54	.98	.55	.4455
5.54	4.82	.72	.6	.3
4.82	3.41	1.41	.8	.4405
3.41	1.84	1.57	2.95	.133
2.31	1.07	1.24	2.4	.129
1.07	.80	.27	1.25	.054
2.9	1.53	1.37	2.1	.163

TABLE D.2. (Cont)

Ln Q		Δ Ln Q	Δt	Slope K
From	To			
1.53	1.13	.40	1.1	.91
1.53	.29	1.24	3.05	.1015
6.89	5.55	1.34	.6	.56
5.55	4.49	1.06	.95	.279
4.49	3.67	.82	.35	.5855
3.67	3.18	.49	.6	.204
6.89	5.67	1.22	.6	.5085
5.67	4.39	1.28	1.35	.237
4.39	3.62	.77	.5	.385
3.62	3.50	.12	.35	.0855
7.25	5.49	1.76	.6	.7335
5.49	4.83	.66	.75	.22
4.83	3.64	1.19	.65	.4075
3.64	1.64	2.0	2.5	.2
1.64	.97	.67	1.5	.1115
5.83	4.47	1.36	.75	.4535
4.47	3.58	.89	.25	.89
3.58	2.8	.78	.5	.39
2.80	1.95	.85	.85	.25
4.23	3.28	.95	.99	.24
3.28	1.88	1.4	3.79	.0975
1.88	1.23	.65	3.04	.0535
2.48	.54	1.94	3.08	.1575
1.26	.92	.34	1.575	.054
-.92	-1.42	.5	.89	.1405
3.23	1.56	1.67	1.43	.292
1.56	.78	.78	1.57	.124
.78	.04	.74	.75	.2465
.04	-.99	1.03	2.25	.1145
4.21	2.32	1.89	1.75	.27
4.18	1.87	2.31	2.59	.223

TABLE D.2. (Cont)

Ln Q		Δ Ln Q	Δt	Slope K
From	To			
2.60	-.55	3.15	3.42	.23
.83	-1.52	2.35	1.75	.3355
-1.52	-1.78	.26	2.81	.023
3.69	2.72	.97	.545	.445
2.72	.15	2.57	1.74	.3695
3.54	2.94	.60	.655	.229
5.48	4.81	.67	.775	.216
4.73	3.69	1.04	.665	.423
3.69	1.12	2.57	2.17	.296
.99	-.47	1.45	1.34	.2705
-.47	-1.02	.55	.61	.2255

APPENDIX E

```
ENVIRONMENTAL PROTECTION AGENCY - STORM WATER MANAGEMENT MODEL  ***  RELEASE  II  ***

     DEVELOPED BY          METCALF + EDDY, INC,

                           UNIVERSITY OF FLORIDA

                           WATER RESOURCES ENGINEERS, INC,

     SEPTEMBER 1970

     UPDATED BY UNIVERSITY OF FLORIDA

     FEBRUARY 1975




                           THIS IS A NEW RELEASE OF THE SWMM, IF ANY PROBLEMS

                           OCCUR IN RUNNING THIS MODEL PLEASE CONTACT WAYNE

                           HUBER OR ALAN PELTZ AT THE UNIVERSITY OF FLORIDA,

                           PHONE 1-904-392-0846




TAPE  OR  DISK  ASSIGNMENTS

      JIN(1)    JIN(2)    JIN(3)    JIN(4)    JIN(5)    JIN(6)    JIN(7)    JIN(8)    JIN(9)   JIN(10)
        0         7         8         -0        -0        -0        -0        -0        -0        -0

     JOUT(1)   JOUT(2)   JOUT(3)   JOUT(4)   JOUT(5)   JOUT(6)   JOUT(7)   JOUT(8)   JOUT(9)  JOUT(10)
        7         8         9         -0        -0        -0        -0        -0        -0        -0

             NSCRAT(1)           NSCRAT(2)           NSCRAT(3)           NSCRAT(4)           NSCRAT(5)
                51                  50                  49                  48                  47
```

```
RUNOFF   BLOCK CALLED


ENTRY MADE TO RUNOFF MODEL
RUNOFF MODEL UPDATED BY UNIVERSITY OF FLORIDA FEBRUARY 1975
```

2

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          LAKE HARRISON   SWALE  8
         APRIL 8,9,1975


BASIN NUMBER   8

NUMBER OF TIME STEPS  150

INTEGRATION TIME INTERVAL (MINUTES),   10,00

25,0 PERCENT OF IMPERVIOUS AREA HAS ZERO DETENTION DEPTH

FOR  11 RAINFALL STEPS, THE TIME INTERVAL IS  20,00 MINUTES

FOR RAINGAGE NUMBER  1,  RAINFALL HISTORY IS

      ,08       ,08       ,08       ,16       ,16       ,16       ,24      0,00       ,72      2,40
     2,40
```

```
* * * * *  G U T T E R   A N D   P I P E   D A T A  * * * * *

GUTTER      GUTTER        WIDTH     LENGTH      SLOPE     SIDE SLOPES      MANNING       OVERFLOW
NUMBER    CONNECTION       (FT)      (FT)      (FT/FT)     L       R          N            (IN)

 1       2     21           4.0      1200.       .001      1.0     3.0        .030         36.00
 2       3      2           3.0       500.       .005      6.0     6.0        .040         24.00
 3       4     22           6.0      2200.       .001      1.0     3.0        .030         36.00
 4       7     24           6.0      1000.       .005      2.0     3.0        .040         48.00

TOTAL NUMBER OF GUTTERS/PIPES,   4

ASTERISK (*) DENOTES CIRCULAR PIPE, DIAMETER=WIDTH.
```

```
* * * * *  S U B C A T C H M E N T   D A T A  * * * * *

SUBCATCH-  GUTTER   WIDTH    AREA   PERCENT    SLOPE    RESISTANCE FACTOR  SURFACE STORAGE(IN)    INFILTRATION   DECAY RATE  GAGE
MENT NO.  OR INLET  (FT)     (AC)   IMPERV.   (FT/FT)    IMPERV.    PERV.   IMPERV.     PERV.      RATE(IN/HR)     (1/SEC)    NO.
                                                                                               MAXIMUM MINIMUM
  1    1     20    2600.0    23.      2.0       .007       .200      .400     .062       .184      .75     .01      .00115      1
  2    2      2    2100.0    47.      3.0       .003       .200      .400     .062       .184      .75     .01      .00115      1
  3    3      3    1150.0    23.     20.0       .006       .200      .400     .062       .184      .75     .01      .00115      1
  4    4      4    3700.0    66.     20.0       .008       .200      .400     .062       .184      .75     .01      .00115      1
  5    5     22    1100.0    44.     20.0       .005       .200      .400     .062       .184      .75     .01      .00115      1
  6    6     22     900.0    28.     20.0       .003       .013      .400     .062       .184      .75     .01      .00115      1
  7    7      7    1300.0    81.     20.0       .001       .013      .400     .062       .184      .75     .01      .00115      1
  8    8     25     700.0    25.     24.4       .003       .013      .250     .062       .184      .75     .01      .00115      1

TOTAL NUMBER OF SUBCATCHMENTS,   8

TOTAL TRIBUTARY AREA (ACRES),  337.50
```

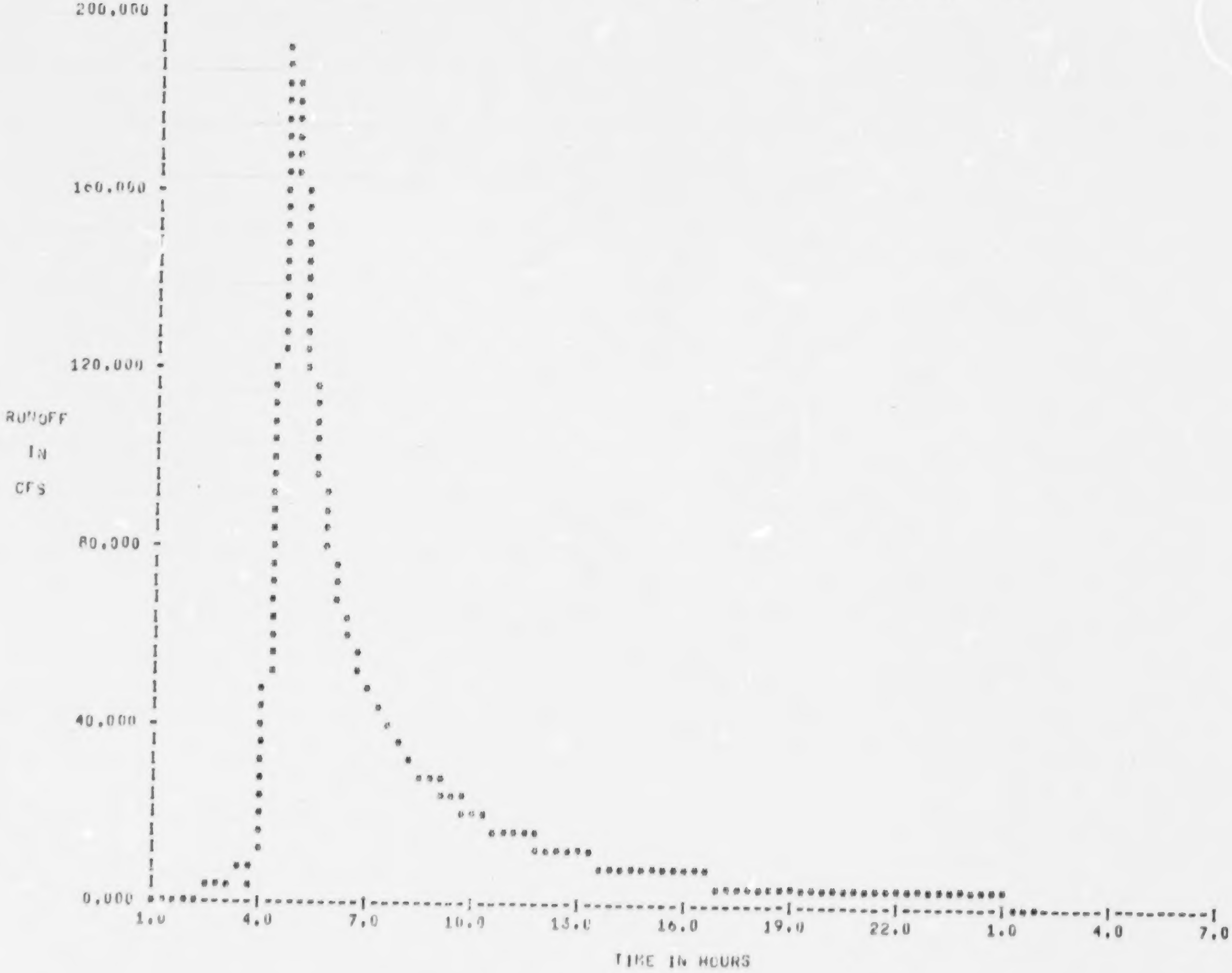
```
ARRANGEMENT OF SUBCATCHMENTS AND GUTTERS/PIPES

   GUTTER    TRIBUTARY GUTTER/PIPE                                   TRIBUTARY SUBAREA
   OR PIPE

     2         3                                                      2

     3                                                                3

     4                                                                4

     7                                                                7

   INLET     TRIBUTARY GUTTERS AND/OR PIPLS                      TRIBUTARY SUBAREAS

    21         2

    22         4                                                      5    6

    24         7

    20                                                                1

    25                                                                8
```

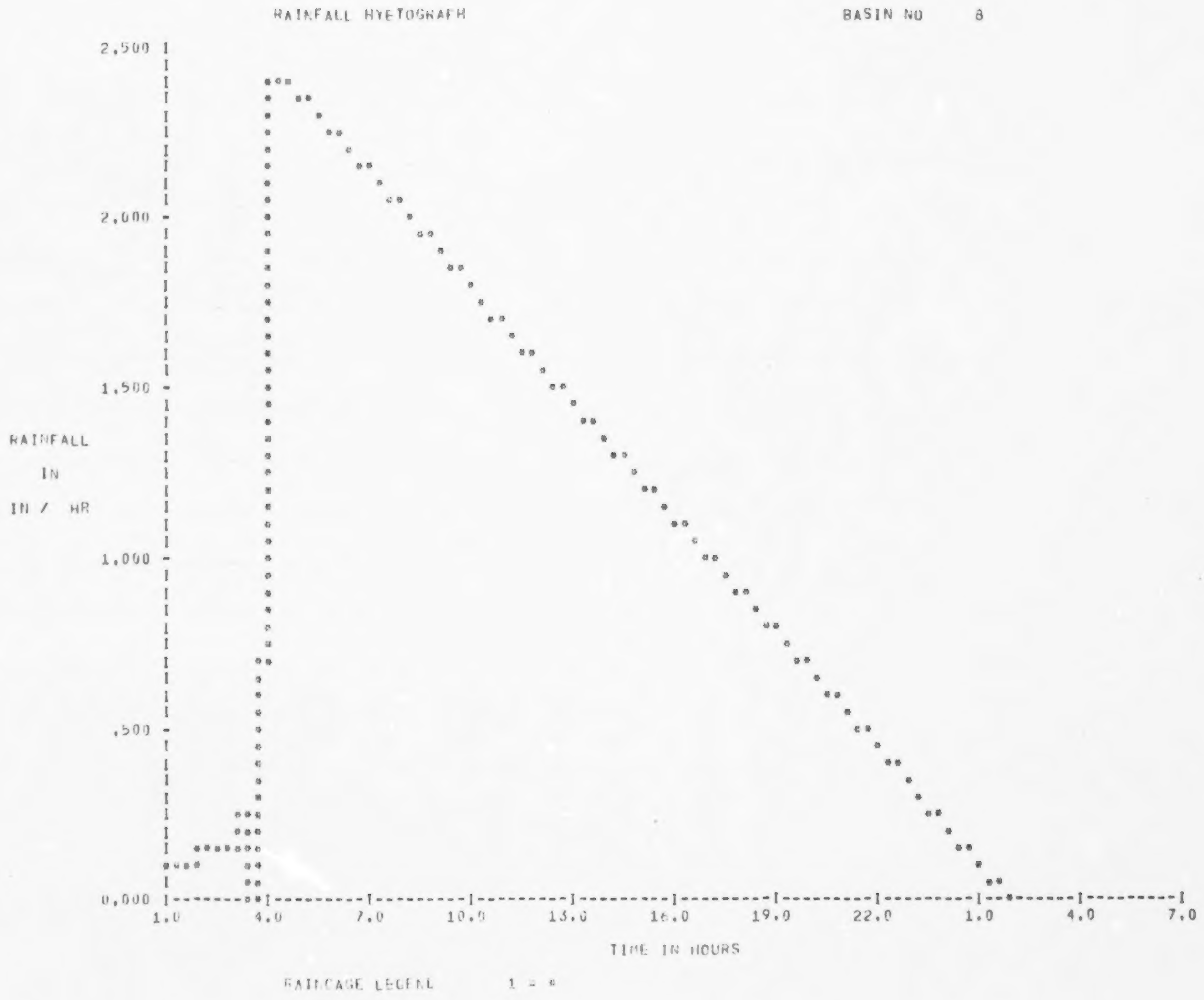
```
HYDROGRAPHS WILL BE STORED FOR THE FOLLOWING   5 INLETS

          21   22   24   20   25



         .....QUALITY SIMULATION INCLUDED IN THIS RUN.....


         INPUT PARAMETERS AS FOLLOWS

         NUMBER OF CONSTITUENTS        8

         NUMBER OF DRY DAYS          5.0

         STREET CLEANING FREQ      -0.0 DAYS

         PASSES PER CLEANING          -0

         STD CATCHBASIN VOLUME    -0.00 FT3

         CATCHBASIN CONTENTS BOD   -0.0 MG/L

         METHOD FOR CALCULATING SS:
           SAME AS FOR ALL OTHER
           POLLUTANTS (VOL. I).
           ISS = 2
```

```
                    TABLE OF POLLUTANT LOADING AND REMOVAL
                         FACTORS INPUT FOR THIS RUN

      ***** POLLUTANT EXPONENTIAL DECAY FACTORS *****

      BOD         SUS-S         COLIF           COD         SET-S           NIT           PO4         K-NIT
************************************************************************************************************
    -0,00          4.60         -0,00          3,00         -0,00         -0.00         -0,00         -0,00

          ***** POLLUTANT LOADING FACTORS *****

      BOD         SUS-S         COLIF           COD         SET-S           NIT           PO4         K-NIT
************************************************************************************************************
  -0,0000       31,0000       -0,0000        3,3000       -0.0000       -0,0000       -0,0000       -0,0000
  -0,0000      101,0000       -0,0000        6,2000       -0.0000       -0,0000       -0,0000       -0,0000
  -0.0000      123.0000       -0,0000        3,1000       -0.0000       -0,0000       -0,0000       -0,0000
```

```
WATERSHED QUALITY DEFINITIONS

SUBAREA    LAND USE    TOTAL  GUTTER        NUMBER  OF
 NUMBER     CLASS.   LENGTH*10**2 FT.   CATCHBASINS

  1    1       1           23.00             0.00
  2    2       1           47.00             0.00
  3    3       2           23.00             0.00
  4    4       2           66.00             0.00
  5    5       2           44.00             0.00
  6    6       2           28.00             0.00
  7    7       2           81.00             0.00
  8    8       2           25.00             0.00
```

INLET HYDROGRAPH BASIN NO 8




RAINFALL HYETOGRAPH
BASIN NO 8
RAINFALL
IN
IN / HR
2,500
2,000
1,500
1,000
,500
0,000
1.0
4.0
7.0
10.0
13.0
16.0
19.0
22.0
1.0
4.0
7.0
TIME IN HOURS
RAINGAGE LEGEND 1 = *

```
HYDROGRAPHS WILL BE LISTED FOR THE FOLLOWING   1 GUTTERS OR INLETS
         22


TOTAL RAINFALL (CU FT)                          .264627E+07
TOTAL INFILTRATION (CU FT)                      .427003E+06
TOTAL GUTTER FLOW AT INLET (CU FT)              .182049E+07
TOTAL SURFACE STORAGE AT END OF STORM (CU FT) .101993E+05
ERROR IN CONTINUITY, PERCENTAGE OF RAINFALL,   14.68381
```

```
THIS IS A SUMMARY OF THE QUANTITY AND QUALITY RESULTS


   LAKE HARRISON   SWALE  8
  APRIL 8,9,1975

NSTEP  NPTS  NOS  DELT      TZERO      TAREA

 150     1    6    600.    3600.0      337.5

THE FOLLOWING INLET/GUTTER NUMBERS WILL BE PRINTED FOR SELECTED TIME STEPS

   22



*****  NOTE!  ONLY THE FIRST THREE POLLUTANTS ARE TRANSFERED TO OTHER BLOCKS.
```

```
      LAKE HARRISON   SWALE  8
     APRIL 8,9,1975

     SUMMARY OF QUANTITY AND QUALITY RESULTS AT LOCATION  22

     FLOW IN CFS AND QUALITY IN MG/L (AND COLIF IN MPN/L)

  TIME        FLOW       BOD      SUS-S      COLIF       COD      SET-S      NIT       PO4      GREASE

  1 30.0       .06    186.21    4649.67  0.              0.00     0.00      0.00      0.00      0.00
  2  -.0       .17    199.54    4973.68  0.              0.00     0.00      0.00      0.00      0.00
  2 30.0       .95    208.49    5159.62  0.              0.00     0.00      0.00      0.00      0.00
  3  -.0      1.76    226.26    5535.15  0.              0.00     0.00      0.00      0.00      0.00
  3 30.0      2.67    238.21    5754.32  0.              0.00     0.00      0.00      0.00      0.00
  4  -.0      6.75    182.55    4317.93  0.              0.00     0.00      0.00      0.00      0.00
  4 30.0     57.19    156.40    3307.46  0.              0.00     0.00      0.00      0.00      0.00
  5  -.0     79.63     85.75    1303.96  0.              0.00     0.00      0.00      0.00      0.00
  5 30.0     52.96     44.05     497.42  0.              0.00     0.00      0.00      0.00      0.00
  6  -.0     37.82     26.72     234.74  0.              0.00     0.00      0.00      0.00      0.00
  6 30.0     28.92     18.33     130.69  0.              0.00     0.00      0.00      0.00      0.00
  7  -.0     23.05     13.74      83.14  0.              0.00     0.00      0.00      0.00      0.00
  7 30.0     18.89     11.03      58.29  0.              0.00     0.00      0.00      0.00      0.00
  8  -.0     15.76      9.21      43.74  0.              0.00     0.00      0.00      0.00      0.00
  8 30.0     13.36      7.93      34.45  0.              0.00     0.00      0.00      0.00      0.00
  9  -.0     11.45      6.98      28.12  0.              0.00     0.00      0.00      0.00      0.00
  9 30.0      9.92      6.25      23.58  0.              0.00     0.00      0.00      0.00      0.00
 10  -.0      8.65      5.67      20.20  0.              0.00     0.00      0.00      0.00      0.00
 10 30.0      7.60      5.20      17.62  0.              0.00     0.00      0.00      0.00      0.00
 11  -.0      6.72      4.82      15.59  0.              0.00     0.00      0.00      0.00      0.00
 11 30.0      5.97      4.50      13.98  0.              0.00     0.00      0.00      0.00      0.00
 12  -.0      5.32      4.23      12.67  0.              0.00     0.00      0.00      0.00      0.00
 12 30.0      4.76      4.01      11.59  0.              0.00     0.00      0.00      0.00      0.00
 13  -.0      4.28      3.81      10.69  0.              0.00     0.00      0.00      0.00      0.00
 13 30.0      3.85      3.64       9.94  0.              0.00     0.00      0.00      0.00      0.00
 14  -.0      3.48      3.49       9.30  0.              0.00     0.00      0.00      0.00      0.00
 14 30.0      3.15      3.37       8.76  0.              0.00     0.00      0.00      0.00      0.00
 15  -.0      2.85      3.25       8.29  0.              0.00     0.00      0.00      0.00      0.00
 15 30.0      2.59      3.16       7.69  0.              0.00     0.00      0.00      0.00      0.00
 16  -.0      2.35      3.07       7.54  0.              0.00     0.00      0.00      0.00      0.00
 16 30.0      2.14      2.99       7.23  0.              0.00     0.00      0.00      0.00      0.00
 17  -.0      1.95      2.92       6.96  0.              0.00     0.00      0.00      0.00      0.00
 17 30.0      1.78      2.86       6.73  0.              0.00     0.00      0.00      0.00      0.00
 18  -.0      1.62      2.81       6.52  0.              0.00     0.00      0.00      0.00      0.00
 18 30.0      1.46      2.76       6.34  0.              0.00     0.00      0.00      0.00      0.00
 19  -.0      1.35      2.71       6.18  0.              0.00     0.00      0.00      0.00      0.00
 19 30.0      1.24      2.68       6.03  0.              0.00     0.00      0.00      0.00      0.00
 20  -.0      1.13      2.64       5.91  0.              0.00     0.00      0.00      0.00      0.00
 20 30.0      1.03      2.61       5.80  0.              0.00     0.00      0.00      0.00      0.00
 21  -.0       .94      2.59       5.70  0.              0.00     0.00      0.00      0.00      0.00
 21 30.0       .86      2.56       5.61  0.              0.00     0.00      0.00      0.00      0.00
 22  -.0       .78      2.54       5.53  0.              0.00     0.00      0.00      0.00      0.00
 22 30.0       .72      2.52       5.46  0.              0.00     0.00      0.00      0.00      0.00
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23  -.0       .65      2.51      5.40  0.        0.00     0.00     0.00     0.00     0.00
23 30.0       .60      2.49      5.35  0.        0.00     0.00     0.00     0.00     0.00
24  -.0       .54      2.48      5.30  0.        0.00     0.00     0.00     0.00     0.00
24 30.0       .50      2.46      5.25  0.        0.00     0.00     0.00     0.00     0.00
25  -.0       .45      2.45      5.20  0.        0.00     0.00     0.00     0.00     0.00
25 30.0       .42      2.44      5.16  0.        0.00     0.00     0.00     0.00     0.00
26  -.0       .38      2.42      5.11  0.        0.00     0.00     0.00     0.00     0.00
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.,.,.,.,.,SURFACE SIMULATION ENDED NORMALLY.,.,.,.,.,
POROUS PAVEMENT MODEL

    * * * POROUS PAVEMENT AT THE WOODLANDS * * * DESIGN STORM* * *



    NUMBER OF CONTRIBUTORY SUBAREAS =          2
    NUMBER OF RAINFALL TIME INTERVALS =        7
    NUMBER OF COMPUTATIONAL STEPS =          150
    NUMBER OF RUNOFF TIME INTERVALS =         -0
    INLET NUMBER =                          25



        SUBAREA CHARACTERISTICS

    SUBAREA        ROUGHNESS     SLOPE        LENGTH       WIDTH          NUMBER         COEFF

       1             ,050        ,030          34,0        180,0
       2             ,017        ,010          80,0         75,0


                  INPUT RAINFALL DATA

 1,500000  3,000000  4,500000  6,000000  4,500000  3,000000  1,500000


    COMPUTATIONAL TIME INTERVAL     5,000  MINUTES



                  INPUT EVAPORATION DATA

    STARTING TIME  12,HR  30,MIN

    EVAPORATION DEPTH FOR   30 DAYS IS    5,000 INCHES
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                 POROUS PAVEMENT CHARACTERISTICS

                               PERM.      DEPTH    POROS-      INIT.       MAX.
                               COEFF                 ITY        STOR.      STOR.

PAVEMENT                      15.000      2.500    30.000     -0.000       .750

SUBGRADE                      30.000     12.000    50.000     -0.000      6.000

NATURAL GROUND                  .500     36.000     5.000     -0.000      1.800

ARTIFICIAL DRAIN               6.000      3.000


     WIDTH OF PAVEMENT =                                     130.000
     LENGTH OF PAVEMENT =                                    210.000
     SLOPE OF PAVEMENT =                                        .030
     DOWNSTREAM FLOW WIDTH OF PAVEMENT =                      15.000
     MANNING COEFFICIENT FOR PAVEMENT =                         .050
     WEIR COEFFICIENT FOR PAVEMENT =                          -0.000
     DEAD STORAGE ON PAVEMENT =                                 .500
     INITIAL STORAGE ON PAVEMENT =                            -0.000
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                    TOTAL INFLOW ONTO THE POROUS PAVEMENT IN INCHES

.635719  1.428200  1.886232  2.122817  1.419986   .817083   .359366   .110314   .072519   .053781
.042376   .034682   .029148   .024987   .021755   .019179   .017083   .015349   .013893   .012657
.011596   .010676   .009873   .009167   .008542   .007985   .007486   .007038   .006633   .006265
.005931   .005625   .005345   .005087   .004849   .004630   .004426   .004238   .004062   .003898
.003745   .003601   .003467   .003341   .003222   .003110   .003004   .002905   .002810   .002721
.002636   .002556   .002480   .002407   .002338   .002272   .002209   .002149   .002092   .002037
.001985   .001934   .001886   .001840   .001796   .001753   .001712   .001673   .001635   .001599
.001563   .001530   .001497   .001465   .001435   .001406   .001377   .001350   .001323   .001298
.001273   .001249   .001225   .001203   .001181   .001160   .001139   .001119   .001099   .001081
.001062   .001044   .001027   .001010   .000994   .000978   .000962   .000947   .000932   .000918
.000904   .000890   .000877   .000864   .000851   .000839   .000827   .000815   .000804   .000792
.000781   .000771   .000760   .000750   .000740   .000730   .000721   .000711   .000702   .000693
.000684   .000676   .000667   .000659   .000651   .000643   .000635   .000628   .000620   .000613
.000606   .000599   .000592   .000585   .000578   .000572   .000566   .000559   .000553   .000547
.000541   .000535   .000530   .000524   .000518   .000513   .000508   .000502   .000497   .000492
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                              POROUS PAVEMENT MODELING RESULTS

                 * * * POROUS PAVEMENT AT THE WOODLANDS * * * DESIGN STORM* * *


                          IN UNITS OF INCHES EXCEPT TIME IN MINUTES

 TIME  INFLOW   OEVAP  INFLOP   OSURF  OVERTP   OHORP  OVERTS   OHORS  OVERTG   SURDEP    STORP    STORS    STORG


   5.    .64     .00     .63    0.00     .63    0.00     .63     .00     .00     0.00     0.00      .13      .00
  10.   1.43     .00    1.43     .67     .56    0.00     .69     .01     .00      .20     0.00      .18      .00
  15.   1.89     .00    2.09    1.25     .82    0.00    1.00     .02     .00      .01     0.00      .49      .00
  20.   2.12     .00    2.13    1.30     .84    0.00    1.33     .03     .00     -.01     0.00      .80      .00
  25.   1.42     .00    1.41     .65     .55    0.00    1.35     .03     .00      .20     0.00      .82      .00
  30.    .82     .00    1.02    0.00    1.02    0.00    1.84     .05     .00     0.00     0.00     1.29      .00
  35.    .36     .00     .36    0.00     .36    0.00    1.65     .04     .00     0.00     0.00     1.10      .01
  40.    .11     .00     .11    0.00     .11    0.00    1.21     .02     .00     0.00     0.00      .69      .01
  45.    .07     .00     .07    0.00     .07    0.00     .76     .01     .00     0.00     0.00      .25      .01
  50.    .05     .00     .05    0.00     .05    0.00     .30     .01     .04     0.00     0.00     0.00      .05
  55.    .04     .00     .04    0.00     .04    0.00     .04     .01     .04     0.00     0.00     0.00      .09
  60.    .03     .00     .03    0.00     .03    0.00     .03     .01     .03     0.00     0.00     0.00      .12
  65.    .03     .00     .03    0.00     .03    0.00     .03     .01     .03     0.00     0.00     0.00      .15
  70.    .02     .00     .02    0.00     .02    0.00     .02     .01     .02     0.00     0.00     0.00      .17
  75.    .02     .00     .02    0.00     .02    0.00     .02     .01     .02     0.00     0.00     0.00      .19
  80.    .02     .00     .02    0.00     .02    0.00     .02     .01     .02     0.00     0.00     0.00      .21
  85.    .02     .00     .01    0.00     .01    0.00     .01     .01     .01     0.00     0.00     0.00      .22
  90.    .02     .00     .01    0.00     .01    0.00     .01     .01     .01     0.00     0.00     0.00      .23
  95.    .01     .00     .01    0.00     .01    0.00     .01     .01     .01     0.00     0.00     0.00      .25
 100.    .01     .00     .01    0.00     .01    0.00     .01     .01     .01     0.00     0.00     0.00      .26
 105.    .01     .00     .01    0.00     .01    0.00     .01     .01     .01     0.00     0.00     0.00      .26
 110.    .01     .00     .01    0.00     .01    0.00     .01     .01     .01     0.00     0.00     0.00      .27
 115.    .01     .00     .01    0.00     .01    0.00     .01     .01     .01     0.00     0.00     0.00      .28
 120.    .01     .00     .01    0.00     .01    0.00     .01     .01     .01     0.00     0.00     0.00      .29
 125.    .01     .00     .01    0.00     .01    0.00     .01     .01     .01     0.00     0.00     0.00      .29
 130.    .01     .00     .01    0.00     .01    0.00     .01     .01     .01     0.00     0.00     0.00      .30
 135.    .01     .00     .01    0.00     .01    0.00     .01     .01     .01     0.00     0.00     0.00      .31
 140.    .01     .00     .00    0.00     .00    0.00     .00     .01     .00     0.00     0.00     0.00      .31
 145.    .01     .00     .00    0.00     .00    0.00     .00     .01     .00     0.00     0.00     0.00      .31
 150.    .01     .00     .00    0.00     .00    0.00     .00     .01     .00     0.00     0.00     0.00      .32
 155.    .01     .00     .00    0.00     .00    0.00     .00     .01     .00     0.00     0.00     0.00      .32
 160.    .01     .00     .00    0.00     .00    0.00     .00     .01     .00     0.00     0.00     0.00      .33
 165.    .01     .00     .00    0.00     .00    0.00     .00     .01     .00     0.00     0.00     0.00      .33
 170.    .01     .00     .00    0.00     .00    0.00     .00     .01     .00     0.00     0.00     0.00      .33
 175.    .00     .00     .00    0.00     .00    0.00     .00     .01     .00     0.00     0.00     0.00      .34
 180.    .00     .00     .00    0.00     .00    0.00     .00     .01     .00     0.00     0.00     0.00      .34
 185.    .00     .00     .00    0.00     .00    0.00     .00     .01     .00     0.00     0.00     0.00      .34
 190.    .00     .00     .00    0.00     .00    0.00     .00     .01     .00     0.00     0.00     0.00      .34
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190.    .00    .00    .00   0.00    .00   0.00    .00    .01    .00   0.00   0.00   0.00    .34
195.    .00    .00    .00   0.00    .00   0.00    .00    .01    .00   0.00   0.00   0.00    .35
200.    .00    .00    .00   0.00    .00   0.00    .00    .01    .00   0.00   0.00   0.00    .35
205.    .00    .00    .00   0.00    .00   0.00    .00    .01    .00   0.00   0.00   0.00    .35
210.    .00    .00    .00   0.00    .00   0.00    .00    .01    .00   0.00   0.00   0.00    .35
215.    .00    .00    .00   0.00    .00   0.00    .00    .01    .00   0.00   0.00   0.00    .35
220.    .00    .00    .00   0.00    .00   0.00    .00    .01    .00   0.00   0.00   0.00    .36
225.    .00    .00    .00   0.00    .00   0.00    .00    .01    .00   0.00   0.00   0.00    .36
230.    .00    .00    .00   0.00    .00   0.00    .00    .01    .00   0.00   0.00   0.00    .36
235.    .00    .00    .00   0.00    .00   0.00    .00    .01    .00   0.00   0.00   0.00    .36
240.    .00    .00    .00   0.00    .00   0.00    .00    .01    .00   0.00   0.00   0.00    .36
245.    .00    .00    .00   0.00    .00   0.00    .00    .01    .00   0.00   0.00   0.00    .36
250.    .00    .00    .00   0.00    .00   0.00    .00    .01    .00   0.00   0.00   0.00    .36
255.    .00    .00    .00   0.00    .00   0.00    .00    .01    .00   0.00   0.00   0.00    .37
260.    .00    .00    .00   0.00    .00   0.00    .00    .01    .00   0.00   0.00   0.00    .37
265.    .00    .00    .00   0.00    .00   0.00    .00    .01    .00   0.00   0.00   0.00    .37
270.    .00    .00    .00   0.00    .00   0.00    .00    .01    .00   0.00   0.00   0.00    .37
275.    .00    .00    .00   0.00    .00   0.00    .00    .01    .00   0.00   0.00   0.00    .37
280.    .00    .00    .00   0.00    .00   0.00    .00    .01    .00   0.00   0.00   0.00    .37
285.    .00    .00    .00   0.00    .00   0.00    .00    .01    .00   0.00   0.00   0.00    .37
290.    .00    .00    .00   0.00    .00   0.00    .00    .01    .00   0.00   0.00   0.00    .37
295.    .00    .00    .00   0.00    .00   0.00    .00    .01    .00   0.00   0.00   0.00    .37
300.    .00    .00    .00   0.00    .00   0.00    .00    .01    .00   0.00   0.00   0.00    .38
305.    .00    .00    .00   0.00    .00   0.00    .00    .01    .00   0.00   0.00   0.00    .38
310.    .00    .00    .00   0.00    .00   0.00    .00    .01    .00   0.00   0.00   0.00    .38
315.    .00    .00    .00   0.00    .00   0.00    .00    .01    .00   0.00   0.00   0.00    .38
320.    .00    .00    .00   0.00    .00   0.00    .00    .01    .00   0.00   0.00   0.00    .38
325.    .00    .00    .00   0.00    .00   0.00    .00    .01    .00   0.00   0.00   0.00    .38
330.    .00    .00    .00   0.00    .00   0.00    .00    .01    .00   0.00   0.00   0.00    .38
335.    .00    .00    .00   0.00    .00   0.00    .00    .01    .00   0.00   0.00   0.00    .38
340.    .00    .00    .00   0.00    .00   0.00    .00    .01    .00   0.00   0.00   0.00    .38
345.    .00    .00    .00   0.00    .00   0.00    .00    .01    .00   0.00   0.00   0.00    .38
350.    .00    .00    .00   0.00    .00   0.00    .00    .01    .00   0.00   0.00   0.00    .39
355.    .00    .00    .00   0.00    .00   0.00    .00    .01    .00   0.00   0.00   0.00    .39
360.    .00    .00    .00   0.00    .00   0.00    .00    .01    .00   0.00   0.00   0.00    .39
365.    .00    .00    .00   0.00    .00   0.00    .00    .01    .00   0.00   0.00   0.00    .39
370.    .00    .00    .00   0.00    .00   0.00    .00    .01    .00   0.00   0.00   0.00    .39
375.    .00    .00    .00   0.00    .00   0.00    .00    .01    .00   0.00   0.00   0.00    .39
380.    .00    .00    .00   0.00    .00   0.00    .00    .01    .00   0.00   0.00   0.00    .39
385.    .00    .00    .00   0.00    .00   0.00    .00    .01    .00   0.00   0.00   0.00    .39
390.    .00    .00    .00   0.00    .00   0.00    .00    .01    .00   0.00   0.00   0.00    .39
395.    .00    .00    .00   0.00    .00   0.00    .00    .01    .00   0.00   0.00   0.00    .39
400.    .00    .00    .00   0.00    .00   0.00    .00    .01    .00   0.00   0.00   0.00    .39
405.    .00    .00    .00   0.00    .00   0.00    .00    .01    .00   0.00   0.00   0.00    .40
410.    .00    .00    .00   0.00    .00   0.00    .00    .01    .00   0.00   0.00   0.00    .40
415.    .00    .00    .00   0.00    .00   0.00    .00    .01    .00   0.00   0.00   0.00    .40
420.    .00    .00    .00   0.00    .00   0.00    .00    .01    .00   0.00   0.00   0.00    .40
425.    .00    .00    .00   0.00    .00   0.00    .00    .01    .00   0.00   0.00   0.00    .40
430.    .00    .00    .00   0.00    .00   0.00    .00    .01    .00   0.00   0.00   0.00    .40
435.    .00    .00    .00   0.00    .00   0.00    .00    .01    .00   0.00   0.00   0.00    .40
440.    .00    .00    .00   0.00    .00   0.00    .00    .01    .00   0.00   0.00   0.00    .40
445.    .00    .00    .00   0.00    .00   0.00    .00    .01    .00   0.00   0.00   0.00    .40
450.    .00   0.00    .00   0.00    .00   0.00    .00    .01    .00   0.00   0.00   0.00    .40
455.    .00   0.00    .00   0.00    .00   0.00    .00    .01    .00   0.00   0.00   0.00    .41
460.    .00   0.00    .00   0.00    .00   0.00    .00    .01    .00   0.00   0.00   0.00    .41
465.    .00   0.00    .00   0.00    .00   0.00    .00    .01    .00   0.00   0.00   0.00    .41
470.    .00   0.00    .00   0.00    .00   0.00    .00    .01    .00   0.00   0.00   0.00    .41
475.    .00   0.00    .00   0.00    .00   0.00    .00    .01    .00   0.00   0.00   0.00    .41
480.    .00   0.00    .00   0.00    .00   0.00    .00    .01    .00   0.00   0.00   0.00    .41
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485.	.00	0.00	.00	0.00	.00	0.00	.00	.01	.00	0.00	0.00	0.00	.41
490.	.00	0.00	.00	0.00	.00	0.00	.00	.01	.00	0.00	0.00	0.00	.41
495.	.00	0.00	.00	0.00	.00	0.00	.00	.01	.00	0.00	0.00	0.00	.41
500.	.00	0.00	.00	0.00	.00	0.00	.00	.01	.00	0.00	0.00	0.00	.41
505.	.00	0.00	.00	0.00	.00	0.00	.00	.01	.00	0.00	0.00	0.00	.42
510.	.00	0.00	.00	0.00	.00	0.00	.00	.01	.00	0.00	0.00	0.00	.42
515.	.00	0.00	.00	0.00	.00	0.00	.00	.01	.00	0.00	0.00	0.00	.42
520.	.00	0.00	.00	0.00	.00	0.00	.00	.01	.00	0.00	0.00	0.00	.42
525.	.00	0.00	.00	0.00	.00	0.00	.00	.01	.00	0.00	0.00	0.00	.42
530.	.00	0.00	.00	0.00	.00	0.00	.00	.01	.00	0.00	0.00	0.00	.42
535.	.00	0.00	.00	0.00	.00	0.00	.00	.01	.00	0.00	0.00	0.00	.42
540.	.00	0.00	.00	0.00	.00	0.00	.00	.01	.00	0.00	0.00	0.00	.42
545.	.00	0.00	.00	0.00	.00	0.00	.00	.01	.00	0.00	0.00	0.00	.42
550.	.00	0.00	.00	0.00	.00	0.00	.00	.01	.00	0.00	0.00	0.00	.42
555.	.00	0.00	.00	0.00	.00	0.00	.00	.01	.00	0.00	0.00	0.00	.42
560.	.00	0.00	.00	0.00	.00	0.00	.00	.01	.00	0.00	0.00	0.00	.42
565.	.00	0.00	.00	0.00	.00	0.00	.00	.01	.00	0.00	0.00	0.00	.43
570.	.00	0.00	.00	0.00	.00	0.00	.00	.01	.00	0.00	0.00	0.00	.43
575.	.00	0.00	.00	0.00	.00	0.00	.00	.01	.00	0.00	0.00	0.00	.43
580.	.00	0.00	.00	0.00	.00	0.00	.00	.01	.00	0.00	0.00	0.00	.43
585.	.00	0.00	.00	0.00	.00	0.00	.00	.01	.00	0.00	0.00	0.00	.43
590.	.00	0.00	.00	0.00	.00	0.00	.00	.01	.00	0.00	0.00	0.00	.43
595.	.00	0.00	.00	0.00	.00	0.00	.00	.01	.00	0.00	0.00	0.00	.43
600.	.00	0.00	.00	0.00	.00	0.00	.00	.01	.00	0.00	0.00	0.00	.43
605.	.00	0.00	.00	0.00	.00	0.00	.00	.01	.00	0.00	0.00	0.00	.43
610.	.00	0.00	.00	0.00	.00	0.00	.00	.01	.00	0.00	0.00	0.00	.43
615.	.00	0.00	.00	0.00	.00	0.00	.00	.01	.00	0.00	0.00	0.00	.43
620.	.00	0.00	.00	0.00	.00	0.00	.00	.01	.00	0.00	0.00	0.00	.43
625.	.00	0.00	.00	0.00	.00	0.00	.00	.01	.00	0.00	0.00	0.00	.43
630.	.00	0.00	.00	0.00	.00	0.00	.00	.01	.00	0.00	0.00	0.00	.43
635.	.00	0.00	.00	0.00	.00	0.00	.00	.01	.00	0.00	0.00	0.00	.44
640.	.00	0.00	.00	0.00	.00	0.00	.00	.01	.00	0.00	0.00	0.00	.44
645.	.00	0.00	.00	0.00	.00	0.00	.00	.01	.00	0.00	0.00	0.00	.44
650.	.00	0.00	.00	0.00	.00	0.00	.00	.01	.00	0.00	0.00	0.00	.44
655.	.00	0.00	.00	0.00	.00	0.00	.00	.01	.00	0.00	0.00	0.00	.44
660.	.00	0.00	.00	0.00	.00	0.00	.00	.01	.00	0.00	0.00	0.00	.44
665.	.00	0.00	.00	0.00	.00	0.00	.00	.01	.00	0.00	0.00	0.00	.44
670.	.00	0.00	.00	0.00	.00	0.00	.00	.01	.00	0.00	0.00	0.00	.44
675.	.00	0.00	.00	0.00	.00	0.00	.00	.01	.00	0.00	0.00	0.00	.44
680.	.00	0.00	.00	0.00	.00	0.00	.00	.01	.00	0.00	0.00	0.00	.44
685.	.00	0.00	.00	0.00	.00	0.00	.00	.01	.00	0.00	0.00	0.00	.44
690.	.00	0.00	.00	0.00	.00	0.00	.00	.01	.00	0.00	0.00	0.00	.44
695.	.00	0.00	.00	0.00	.00	0.00	.00	.01	.00	0.00	0.00	0.00	.44
700.	.00	0.00	.00	0.00	.00	0.00	.00	.01	.00	0.00	0.00	0.00	.44
705.	.00	0.00	.00	0.00	.00	0.00	.00	.01	.00	0.00	0.00	0.00	.44
710.	.00	0.00	.00	0.00	.00	0.00	.00	.01	.00	0.00	0.00	0.00	.44
715.	.00	0.00	.00	0.00	.00	0.00	.00	.01	.00	0.00	0.00	0.00	.44
720.	.00	0.00	.00	0.00	.00	0.00	.00	.01	.00	0.00	0.00	0.00	.44
725.	.00	0.00	.00	0.00	.00	0.00	.00	.01	.00	0.00	0.00	0.00	.45
730.	.00	0.00	.00	0.00	.00	0.00	.00	.01	.00	0.00	0.00	0.00	.45
735.	.00	0.00	.00	0.00	.00	0.00	.00	.01	.00	0.00	0.00	0.00	.45
740.	.00	0.00	.00	0.00	.00	0.00	.00	.01	.00	0.00	0.00	0.00	.45
745.	.00	0.00	.00	0.00	.00	0.00	.00	.01	.00	0.00	0.00	0.00	.45
750.	.00	0.00	.00	0.00	.00	0.00	.00	.01	.00	0.00	0.00	0.00	.45

```
* * * POROUS PAVEMENT AT THE WOODLANDS * * * DESIGN STORM* * *


SURFACE RUNOFF HYDROGRAPH, IN INCHES

0,000000  ,665660 1,251752 1,300862  ,652502 0,000000 0,000000 0.000000 0,000000 0,000000
0,000000 0,000000 0,000000 0,000000 0,000000 0,000000 0,000000 0.000000 0,000000 0,000000
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HYDROGRAPH OF OUTFLOW THRU DRAIN , IN INCHES

 ,500000  ,500000  ,500000  ,500000  ,500000  ,500000  ,500000  ,500000  ,500000  ,258144
0,000000 0,000000 0,000000 0,000000 0,000000 0.000000 0,000000 0,000000 0,000000 0,000000
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```

```
COMBINE  BLOCK CALLED


ENTRY MADE TO COMBINE MODEL
COMBINE MODEL UPDATED BY UNIVERSITY OF FLORIDA AUGUST 1974
```

```
* * * * * * * * * *  COMBINE RUNOFF AND PORPAV OUTPUT * * * * * * * * * *


     OUTPUT DATA-SET UNIT NUMBER IS  9

     THERE ARE 2 DATA-SETS TO BE COMBINED
          DATA-SET UNIT NUMBERS ARE    7    8

     THERE ARE  7 OUTPUT NODES
          NODE NUMBERS ARE   21   22   24   20   25   26   27


RUN COMPLETE
```

```
TRANSPOR BLOCK CALLED


ENTRY MADE TO TRANSPORT MODEL
TRANSPORT MODEL UPDATED BY UNIVERSITY OF FLORIDA FEBRUARY 1975
```

```
PHASE I


* * * * *  ELEMENT LINKAGES AND COMPUTATION SEQUENCE  * * * * *

ELEMENT NO. ZERO IS GIVEN INTERNAL NO. = NO. ELEMENTS + 1 =  12

EXTERNAL INTERNAL TYPE  DESCRIPTION      UPSTREAM ELEMENTS         ORDER OF COMPUTATIONS AT EACH TIME STEP (PROCEEDING DOWNSTREAM)
ELEMENT  ELEMENT                          (EXTERNAL NOS.)                   COMPUTATION  EXTERNAL INTERNAL  INTERNAL UPSTREAM
NUMBER   NUMBER                            1    2    3                      SEQUENCE     NUMBER   NUMBER    ELEMENT NUMBERS

   20       1     26    MANHOLE           -0   -0   -0                          1           20       1       12   12   12
    2       2     13    TRAPEZOID         20   -0   -0                          2            2       2        1   12   12
   21       3     26    MANHOLE            2   -0   -0                          3           21       3        2   12   12
    4       4     13    TRAPEZOID         21   -0   -0                          4            4       4        3   12   12
   22       5     26    MANHOLE            4   -0   -0                          5           22       5        4   12   12
    6       6     13    TRAPEZOID         22   -0   -0                          6            6       6        5   12   12
   23       7     26    MANHOLE            6   -0   -0                          7           23       7        6   12   12
    7       8     13    TRAPEZOID         23   -0   -0                          8            7       8        7   12   12
   24       9     26    MANHOLE            7   -0   -0                          9           24       9        8   12   12
    8      10     13    TRAPEZOID         24   -0   -0                         10            8      10        9   12   12
   25      11     26    MANHOLE            8   -0   -0                         11           25      11       10   12   12
```

```
* * * * * * * * * * *  COMBINE RUNOFF AND PORPAV OUTPUT * * * * * * * * * * *

       NUMBER OF ELEMENTS =   11
       NUMBER OF TIME INT =  150
       TIME INTERVAL      = 300,0 SECONDS

* * * * *  ELEMENT PARAMETERS  * * * * *

EXT. TYPE  DESCRIPTION          SLOPE  DISTANCE  MANNING    GEOM1  GEOM2  GEOM3  NUMBER   AFULL   QFULL    QMAX    SUPER-CRITICAL
ELE.                           (FT/FT)   (FT)    ROUGHNESS   (FT)   (FT)   (FT)    OF   (SQ.FT)  (CFS)    (CFS)    FLOW WHEN LESS
NUM.                                                                             BARRELS                           THAN 95( FULLA
  20   26    MANHOLE            .1000     -0.0     .0130     0.0   -0.0   -0.0    1;0    0,000    0.000    0.000
   2   13    TRAPEZOID          .0010   1200.0     .0300     3.0    4.0    1.0    1.0   21.000   46.648   46.648     NO
  21   26    MANHOLE            .1000     -0.0     .0130     0.0   -0.0   -0.0    1.0    0.000    0.000    0.000
   4   13    TRAPEZOID          .0010   2200.0     .0300     3.0    6.0    1.0    1.0   27.000   64.227   64.227     NO
  22   26    MANHOLE            .1000     -0.0     .0130     0.0   -0.0   -0.0    1.0    0.000    0.000    0.000
   6   13    TRAPEZOID          .0005   1200.0     .0300     3.0   20.0    6.0    1.0   61.500  120.997  120.997     NO
  23   26    MANHOLE            .1000     -0.0     .0130     0.0   -0.0   -0.0    1.0    0.000    0.000    0.000
   7   13    TRAPEZOID          .0050   1000.0     .0400     3.5    6.0    2.0    1.0   27.125  111.967  111.967     NO
  24   26    MANHOLE            .1000     -0.0     .0130     0.0   -0.0   -0.0    1.0    0.000    0.000    0.000
   8   13    TRAPEZOID          .0050    300.0     .0400     4.0    6.0    2.0    1.0   32.000  140.027  140.027     NO
  25   26    MANHOLE            .1000     -0.0     .0130     0.0   -0.0   -0.0    1.0    0.000    0.000    0.000

 EPSILON =  .000100      NO. OF ITERATIONS IN ROUTING ROUINE =    4


HYDROGRAPHS PROVIDED TO SUBSEQUENT BLOCKS FOR THE FOLLOWING ELEMENTS:

   24   25
```

```
* * * * * * * * * *  COMBINE RUNOFF AND PORPAV OUTPUT * * * * * * * * * *

TOTAL SIMULATION TIME = 45000.0 SECONDS, TIME STEP = 300.0 SECONDS,

INFLOW HYDROGRAPHS AT THE FOLLOWING EXTERNAL ELEMENT NUMBERS:

  21   22   24   20   25   26   27

                                         SELECTED INLET HYDROGRAPHS - CFS
EXTERNAL
ELEMENT    TIME STEP
NUMBER         1         2         3         4         5         6         7         8         9        10

  20         ,000      ,002      ,005      ,006      ,008      ,008      ,009      ,009      ,009      ,010
             ,015      ,021      ,035      ,053      ,064      ,070      ,072      ,074      ,074      ,075
             ,075      ,075      ,075      ,075      ,085      ,101      ,108      ,110      ,079      ,040
             ,023      ,015      ,085      ,253      ,318      ,333      ,687     1,948     3,631     5,905
            8,599    11,570    14,699    17,885    18,117    16,101    14,652    13,402    12.299    11,317
           10,437     9,645     8,929     8,282     7.693     7,156     6,667     6,218     5.807     5,428
            5,080     4,758     4,461     4,186     3,930     3,693     3,472     3,266     3.074     2,895
            2,727     2.570     2.423     2,285     2,155     2,033     1,918     1,810     1.708     1,611
            1,520     1,434     1,353     1,276     2,490     5,597     8,460    11,576    12,565    11,797
           11,426    11,119    10,846    10,597    10,368    10,156     9,961     9,781     9.613     9,458
            9,314     9,181     9,057     8,941     8,834     8,734     8,640     8,553     8,472     8,397
            8,326     8,260     8,199     8,141     8,087     8,037     7,990     7,945     7,904     7,865
            7,523     6,950     6,459     6,020     5,620     5,254     4,918     4,608     4,321     4,055
            3,809     3,580     3,366     3,168     2,982     2,809     2,646     2,494     2,352     2,218
            2,092     1,974     1,862     1,757     1.658     1,564     1,476     1,393     1,313     1,239

  22         ,006      ,029      ,051      ,066      ,075      ,081      ,085      ,088      ,091      ,098
             ,163      ,237      ,377      ,558      ,653      ,708      ,747      ,782      ,815      ,846
             ,878      ,908      ,936      ,964     1,104     1,297     1,390     1,449     1.138      ,747
             ,592      ,503     1.316     3,131     3,691     3,969     7,985    13,939    17.108    22,025
           27,914    34,946    43.063    52,170    52,234    48,939    48,134    47,038    45.667    44,114
           42,458    40,762    39.070    37,410    35,798    34,251    32,771    31,361    30.020    28,747
           27.539    26,393    25.306    24,275    23,296    22,367    21,483    20,643    19,844    19,082
           18,357    17.665    17.005    16,375    15,772    15,196    14,645    14,118    13,612    13,127
           12,662    12.216    11.788    11,377    16,673    28,803    35,571    44,647    46,097    44,710
           45,843    46,630    47.122    47,388    47,496    47,492    47,413    47,285    47,125    46,947
           46,760    46,570    46.383    46,199    46,023    45,853    45,692    45,538    45,393    45,256
           45,127    45,005    44.891    44,783    44,682    44,587    44,498    44,414    44,335    44,261
           43,105    41.293    39.746    38,241    36,764    35,325    33,930    32,589    31.303    30,073
           28,899    27.779    26.711    25,693    24,723    23,798    22,916    22,074    21,270    20,502
           19,768    19,066    18.394    17,751    17,135    16,544    15,978    15,435    14,912    14,411
```

```
ELEMENT FLOWS, AREAS, AND CONCENTRATIONS ARE INITIALIZED TO DRY WEATHER FLOW AND INFILTRATION VALUES.

                     FLOW      AREA      INIT. VEL.
ELE. NO.   TYPE     (CFS)   (SQ. FT.)      (FPS)
```

```
                                         SELECTED OUTFLOW HYDROGRAPHS - CFS
EXTERNAL
ELEMENT    TIME STEP
NUMBER        1         2         3         4         5         6         7         8         9         10

  24         .000      .000      .001      .002      .006      .010      .017      .025      .033      .042
             .056      .075      .109      .173      .267      .383      .502      .610      .702      .780
             .855      .937     1.031     1.133     1.268     1.410     1.539     1.690     1.760     1.798
            1.892     1.875     2.055     2.086     2.377     3.200     5.157     8.654    13.427    19.500
           26.328    34.088    43.292    54.959    66.531    73.629    77.895    82.875    86.888    86.264
           88.040    84.793    84.398    83.259    80.626    77.487    74.291    71.151    68.236    65.445
           62.809    60.330    57.987    55.775    53.683    51.702    49.824    48.041    46.346    44.734
           43.197    41.732    40.333    38.996    37.717    36.493    35.320    34.195    33.116    32.081
           31.087    30.139    29.222    28.337    28.392    32.368    46.051    57.457    66.247    71.720
           74.651    79.155    84.639    89.045    91.712    94.537    95.210    96.844    96.666    97.568
           97.098    97.538    96.888    97.000    97.072    96.976    96.776    96.575    96.381    96.227
           96.072    95.933    95.809    95.700    95.599    95.518    95.445    95.381    95.326    95.279
           95.002    94.116    92.221    90.002    87.876    85.573    83.067    80.428    77.745    75.084
           72.487    69.978    67.567    65.260    63.054    60.947    58.935    57.011    55.172    53.413
           51.728    50.113    48.565    47.079    45.652    44.281    42.962    41.694    40.473    39.296

  25        3.792     8.840    13.284    13.657     8.740     3.792     3.792     3.793     3.797     1.971
             .022      .035      .052      .082      .142      .243      .373      .503      .623      .716
             .796      .874      .962     1.061     1.174     1.317     1.459     1.596     1.725     1.774
            1.833     1.892     1.937     2.081     2.196     2.742     4.192     7.229    11.829    17.694
           24.533    32.154    41.116    52.334    64.247    72.496    77.144    81.848    86.211    86.681
           87.401    85.978    83.959    83.754    81.136    78.158    74.902    71.813    68.818    66.006
           63.338    60.635    58.469    56.234    54.121    52.121    50.225    48.425    46.714    45.087
           43.537    42.058    40.647    39.299    38.009    36.775    35.593    34.459    33.371    32.327
           31.326    30.368    29.447    28.554    28.275    31.138    42.304    55.491    64.488    70.839
           74.147    78.147    83.582    88.283    91.278    93.970    95.222    96.430    96.871    97.239
           97.354    97.320    97.157    96.849    97.109    96.986    96.837    96.616    96.428    96.258
           96.110    95.963    95.838    95.724    95.622    95.535    95.462    95.395    95.338    95.290
           95.090    94.324    92.658    90.415    88.278    86.036    83.561    80.951    78.272    75.608
           73.000    70.476    68.049    65.724    63.501    61.378    59.349    57.410    55.557    53.783
           52.085    50.459    48.899    47.402    45.964    44.583    43.255    41.977    40.748    39.563
```

```
GRAPH    BLOCK CALLED
```

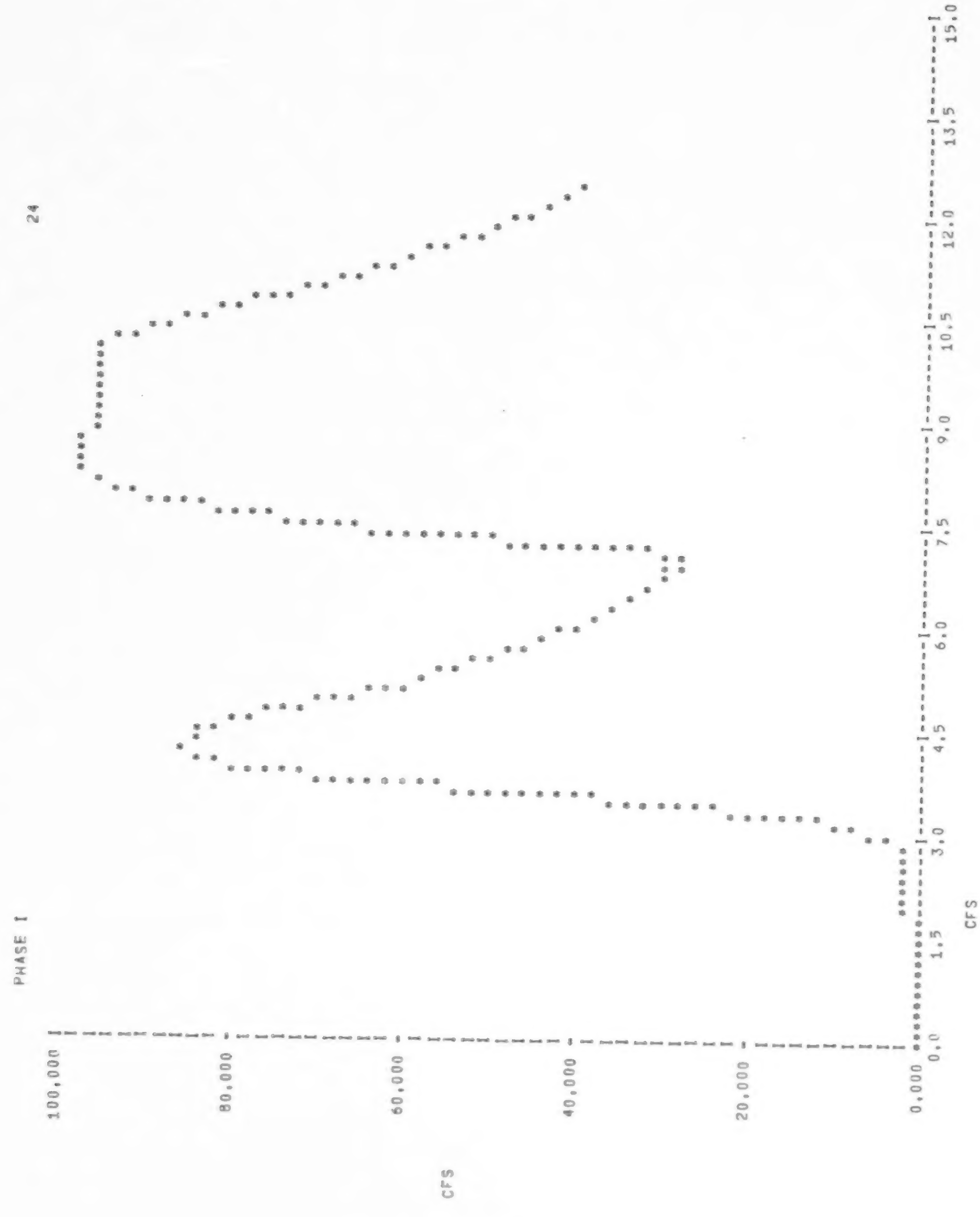
```
HYDROGRAPHS WILL BE PLOTTED FOR THE FOLLOWING    2 POINTS
     24         25

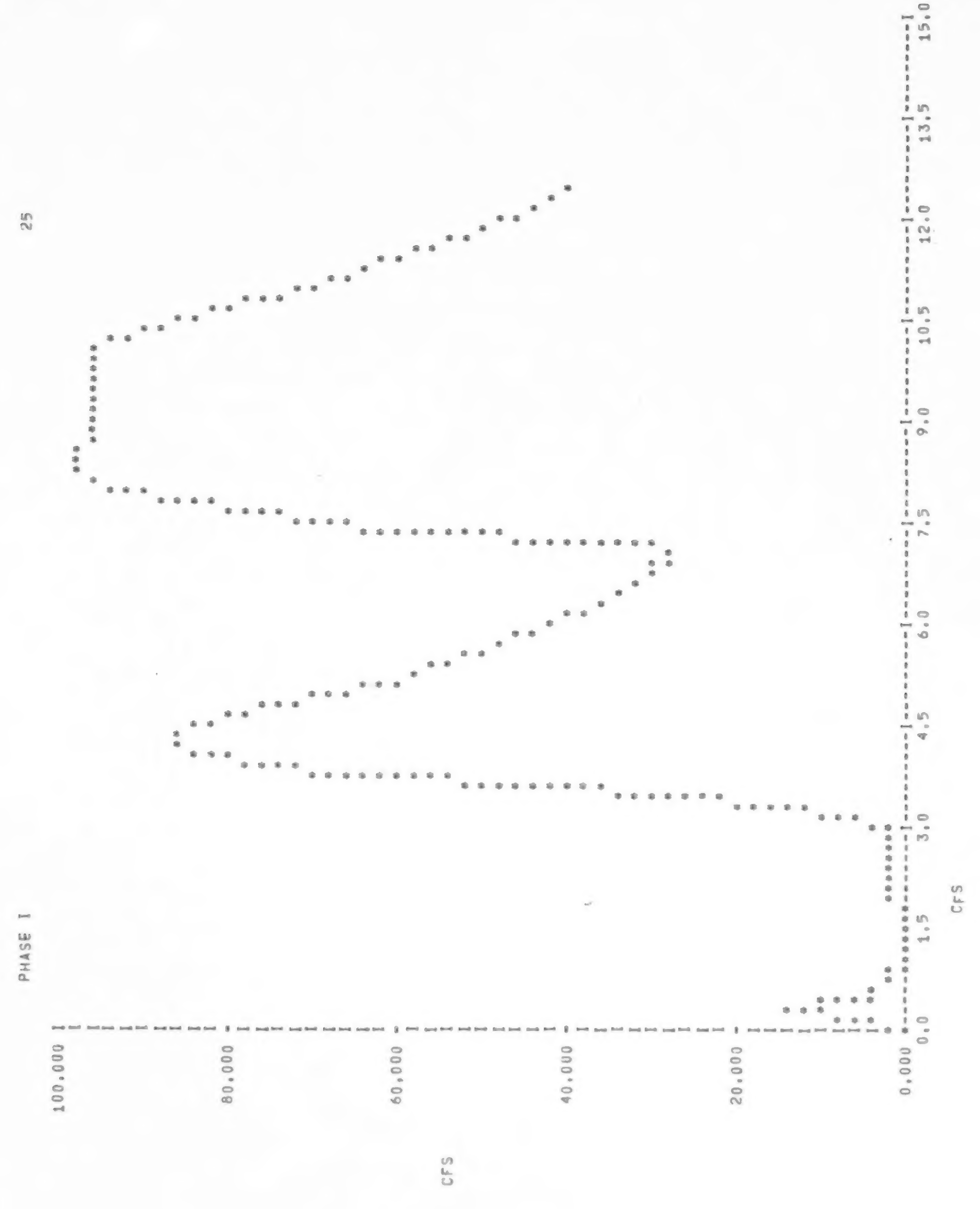
     NSTEPS     NCURVE      NQUAL   TDELT      TZERO     TAREA
      150          2          0     300.0        0.0   12579.3

STORED HYDROGRAPHS FOR THE FOLLOWING     2 POINTS

     24         25
```

```
OUTPUT WILL BE PLOTTED FOR TAPE   10  IN BLOCKS OF     1
```


PHASE I
24
CFS
100,000
80,000
60,000
40,000
20,000
0.000
0.0
1.5
3.0
4.5
6.0
7.5
9.0
10.5
12.0
13.5
15.0
CFS


PHASE I
25
CFS
100.000
80.000
60.000
40.000
20.000
0.000
CFS
0.0
1.5
3.0
4.5
6.0
7.5
9.0
10.5
12.0
13.5
15.0

```
BASEFLO  BLOCK CALLED
```

```
          * * * * * * * * * *  COMBINE RUNOFF AND PORPAV OUTPUT * * * * * * * * * *


MAXIMUM NUMBER OF TIME-STEPS =                        150

INTEGRATION PERIOD =                                 5,00 MINUTES

BASEFLOW HYDROGRAPH FROM ELEMENT NUMBER     25
CONSTANT GROUNDWATER FUNCTION VALUE =                 ,10 CFS



                  RECESSION DATA

   STARTING         NATURAL LOG        RECESSION          RECESSION
RECESSION FLOW        OF FLOW          INTERCEPT            SLOPE
     CFS                CFS           COEFFICIENT        COEFFICIENT

    50,00             3,9100            0,0000              ,3400
    88,50             4,4800           -6,3400             2,0000
```

```
* * * * * * * * * *  COMBINE RUNOFF AND PORPAV OUTPUT * * * * * * * * * *


 SURFACE    GROUND   RECESSION      GROUND          SURFACE       RECESSION     CUMULATIVE     CUMULATIVE         TOTAL
 RUNOFF     WATER       FLOW        WATER           RUNOFF         RUNOFF       RECESSION     STORM RUNOFF      HYDROGRAPH
   CFS       CFS        CFS         CU FT           CU FT          CU FT          CU FT          CU FT             CFS

    3.79       .10       0.00         0.00            0.00           0.00           0.00            0.00            3.89
    8.84       .10       0.00        30.00         1864.69           0.00           0.00         1894.59            8.94
   13.28       .10       0.00        30.00         3288.56           0.00           0.00         5213.25           13.38
   13.66       .10       0.00        30.00         4011.10           0.00           0.00         9254.34           13.76
    8.74       .10       0.00        30.00         3329.45           0.00           0.00        12613.79            8.84
    3.79       .10       0.00        30.00         1849.72           0.00           0.00        14493.52            3.89
    3.79       .10       0.00        30.00         1107.52           0.00           0.00        15631.04            3.89
    3.79       .10       0.00        30.00         1107.74           0.00           0.00        16768.78            3.89
    3.80       .10       0.00        30.00         1108.56           0.00           0.00        17907.34            3.90
    1.97       .10       0.00        30.00          835.19           0.00           0.00        18772.53            2.07
     .02       .10       0.00        30.00          268.91           0.00           0.00        19071.44             .12
     .03       .10       0.00        30.00          -21.45           0.00           0.00        19079.99             .13
     .05       .10       0.00        30.00          -16.89           0.00           0.00        19093.10             .15
     .08       .10       0.00        30.00           -9.85           0.00           0.00        19113.25             .18
     .14       .10       0.00        30.00            3.56           0.00           0.00        19146.80             .24
     .24       .10       0.00        30.00           27.66           0.00           0.00        19204.46             .34
     .37       .10       0.00        30.00           62.28           0.00           0.00        19296.74             .47
     .50       .10       0.00        30.00          101.37           0.00           0.00        19428.11             .60
     .62       .10       0.00        30.00          138.90           0.00           0.00        19597.01             .72
     .72       .10       0.00        30.00          170.80           0.00           0.00        19797.81             .82
     .80       .10       0.00        30.00          196.72           0.00           0.00        20024.53             .90
     .87       .10       0.00        30.00          220.49           0.00           0.00        20275.02             .97
     .96       .10       0.00        30.00          245.40           0.00           0.00        20550.42            1.06
    1.06       .10       0.00        30.00          273.36           0.00           0.00        20853.78            1.16
    1.17       .10       0.00        30.00          305.21           0.00           0.00        21188.98            1.27
    1.32       .10       0.00        30.00          343.66           0.00           0.00        21562.64            1.42
    1.46       .10       0.00        30.00          386.36           0.00           0.00        21979.00            1.56
    1.60       .10       0.00        30.00          428.16           0.00           0.00        22437.16            1.70
    1.73       .10       0.00        30.00          468.16           0.00           0.00        22935.32            1.83
    1.77       .10       0.00        30.00          494.95           0.00           0.00        23460.27            1.87
    1.83       .10       0.00        30.00          511.10           0.00           0.00        24001.37            1.93
    1.89       .10       0.00        30.00          528.76           0.00           0.00        24560.13            1.99
    1.94       .10       0.00        30.00          544.44           0.00           0.00        25134.56            2.04
    2.08       .10       0.00        30.00          572.79           0.00           0.00        25737.35            2.18
    2.20       .10       0.00        30.00          611.64           0.00           0.00        26378.99            2.30
    2.74       .10       0.00        30.00          710.79           0.00           0.00        27119.78            2.84
    4.19       .10       0.00        30.00         1010.12           0.00           0.00        28159.89            4.29
    7.23       .10       0.00        30.00         1683.17           0.00           0.00        29873.06            7.33
   11.83       .10       0.00        30.00         2828.76           0.00           0.00        32731.82           11.93
   17.69       .10       0.00        30.00         4398.51           0.00           0.00        37160.34           17.79
   24.53       .10       0.00        30.00         6304.06           0.00           0.00        43494.40           24.63
   32.15       .10       0.00        30.00         8473.10           0.00           0.00        51997.50           32.25
   41.12       .10       0.00        30.00        10960.60           0.00           0.00        62988.10           41.22
   52.33       .10       0.00        30.00        13987.52           0.00           0.00        77005.62           52.43
   64.25       .10       0.00        30.00        17457.17           0.00           0.00        94492.80           64.35
   72.50       .10       0.00        30.00        20481.53           0.00           0.00       115004.33           72.60
   77.14       .10       0.00        30.00        22415.98           0.00           0.00       137450.31           77.24
   81.85       .10       0.00        30.00        23818.81           0.00           0.00       161299.12           81.95
   86.21       .10       0.00        30.00        25178.88           0.00           0.00       186507.99           86.31
   86.68       .10       0.00        30.00        25903.82           0.00           0.00       212441.81           86.78
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85.98   .10    0.00    30.00   25976.91        0.00        0.00    264561.12   86.08
83.96   .10    0.00    30.00   25460.51        0.00        0.00    290051.63   84.06
83.75   .10    0.00    30.00   25126.93        0.00        0.00    315208.56   83.85
81.14   .10    0.00    30.00   24703.52        0.00        0.00    339942.07   81.24
78.16   .10    0.00    30.00   23864.05        0.00        0.00    363836.12   78.26
74.90   .10   74.90    30.00   22929.02        0.00        0.00    386795.15   75.00
71.81   .10   73.72    30.00       0.00    22263.26    22263.26    409088.40   73.82
68.82   .10   72.57    30.00       0.00    21913.58    44176.84    431031.98   72.67
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63.34   .10   70.37    30.00       0.00    21244.54    86995.52    473910.66   70.47
60.84   .10   69.32    30.00       0.00    20924.46   107919.97    494865.12   69.42
58.47   .10   68.30    30.00       0.00    20613.53   128533.51    515508.65   68.40
56.23   .10   67.31    30.00       0.00    20311.44   148844.95    535850.10   67.41
54.12   .10   66.34    30.00       0.00    20017.88   168862.83    555897.98   66.44
52.12   .10   65.41    30.00       0.00    19732.54   188595.37    575660.52   65.51
50.22   .10   64.49    30.00       0.00    19455.15   208050.52    595145.66   64.59
48.42   .10   63.61    30.00       0.00    19185.42   227235.93    614361.08   63.71
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45.09   .10   61.91    30.00       0.00    18667.91   264826.93    652012.08   62.01
43.54   .10   61.09    30.00       0.00    18419.64   283246.58    670461.73   61.19
42.06   .10   60.30    30.00       0.00    18178.05   301424.63    688669.78   60.40
40.65   .10   59.52    30.00       0.00    17942.92   319367.55    706642.70   59.62
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35.59   .10   56.63    30.00       0.00    17062.75   388909.60    776304.75   56.73
34.46   .10   55.95    30.00       0.00    16856.83   405766.44    793191.58   56.05
33.37   .10   55.29    30.00       0.00    16656.21   422422.64    809877.79   55.39
32.33   .10   54.65    30.00       0.00    16460.70   438883.35    826368.49   54.75
31.33   .10   54.02    30.00       0.00    16270.16   455153.50    842668.65   54.12
30.37   .10   53.41    30.00       0.00    16084.41   471237.92    858783.07   53.51
29.45   .10   52.81    30.00       0.00    15903.32   487141.24    874716.39   52.91
28.55   .10   52.23    30.00       0.00    15726.74   502867.98    890473.13   32.33
28.27   .10   51.66    30.00       0.00    15554.53   518422.51    906057.66   31.76
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42.30   .10    0.00    30.00   10986.40        0.00        0.00    925986.00   42.40
55.49   .10    0.00    30.00   14639.35        0.00        0.00    940655.34   55.59
64.49   .10    0.00    30.00   17966.89        0.00        0.00    958652.23   64.59
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74.15   .10    0.00    30.00   21717.99        0.00        0.00   1000699.31   74.25
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96,11     ,10    0,00      30,00    28825.20        0,00        0,00   1563218,59        96,21
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86,04     ,10    0,00      30,00    26117.13        0,00        0,00   1986820.00        86,14
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80,95     ,10    0,00      30,00    24646.82        0,00        0,00   2036936,44        81,05
78,27     ,10   78,27      30.00    23853,42        0,00        0,00   2060819,86        78,37
75.61     ,10   76,99      30,00        0.00    23259,14    23259,14   2084109,00        77.09
73,00     ,10   75,74      30,00        0,00    22879,94    46139,08   2107018,94        75,84
70,48     ,10   74,54      30,00        0,00    22512,04    68651.13   2129560,98        74,64
68,05     ,10   73,36      30,00        0,00    22155.05    90806,17   2151746.03        73,46
65.72     ,10.  72,23      30,00        0,00    21808,54   112614.72   2173584,57        72,33
63,50     ,10   71,12      30,00        0,00    21472.16   134086,87   2195086,73        71,22
61.38     ,10   70,05      30,00        0.00    21145,51   155232,39   2216262.24        70,15
59,35     ,10   69,01      30,00        0,00    20828,27   176060,65   2237120.51        69.11
57.41     ,10   67,99      30,00        0,00    20520,08   196580,74   2257670,59        68,09
55,56     ,10   67,01      30,00        0,00    20220.64   216801.37   2277921.23        67,11
53.78     ,10   66,05      30,00        0.00    19929,62   236731,00   2297880,85        66.15
52,09     ,10   65,12      30.00        0,00    19646,75   256377,75   2317557,60        65,22
50,46     ,10   64,22      30,00        0,00    19371,73   275749,48   2336959,33        64,32
48,90     ,10   63,34      30,00        0,00    19104,29   294853,77   2356093,63        63,44
47,40     ,10   62,49      30,00        0,00    18844,18   313697,96   2374967,81        62.59
45,96     ,10   61,65      30,00        0,00    18591.15   332289,10   2393588,96        61,75
44,58     ,10   60,85      30,00        0,00    18344,95   350634.06   2411963,91        60,95
43,26     ,10   60,06      30,00        0,00    18105,36   368739,41   2430099.27        60,16
41,98     ,10   59,29      30,00        0.00    17872,16   386611,57   2448001.42        59.39
40,75     ,10   58,54      30.00        0,00    17645,13   404256,70   2465676,55        58,64
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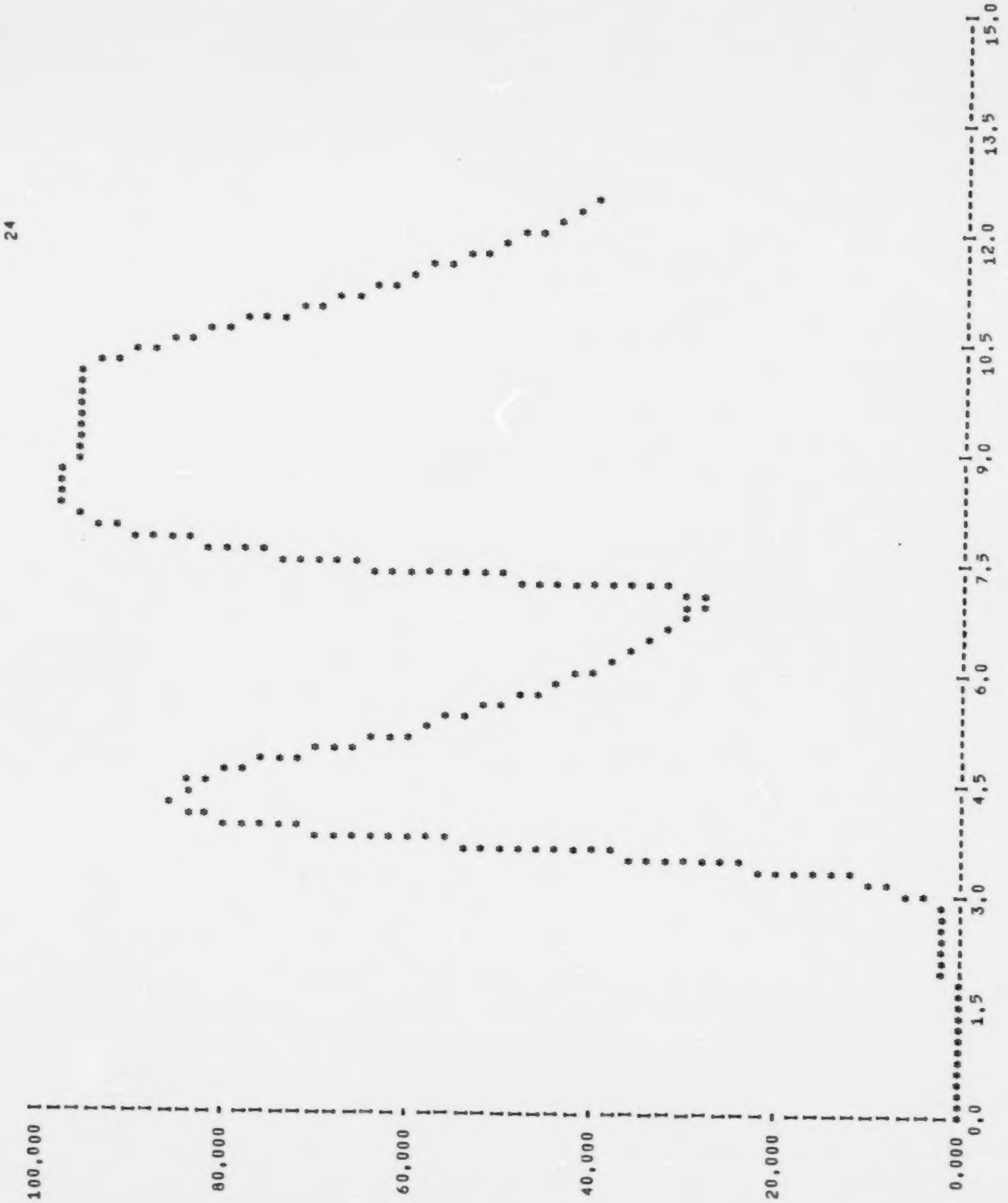
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HYDROGRAPHS WILL BE PLOTTED FOR THE FOLLOWING    2 POINTS
      24        25

     NSTEPS    NCURVE     NQUAL   TDELT     TZERO     TAREA
      150         2         0     300.0       0.0   12579.3

STORED HYDROGRAPHS FOR THE FOLLOWING     2 POINTS

      24        25
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OUTPUT WILL BE PLOTTED FOR TAPE   11  IN BLOCKS OF     1
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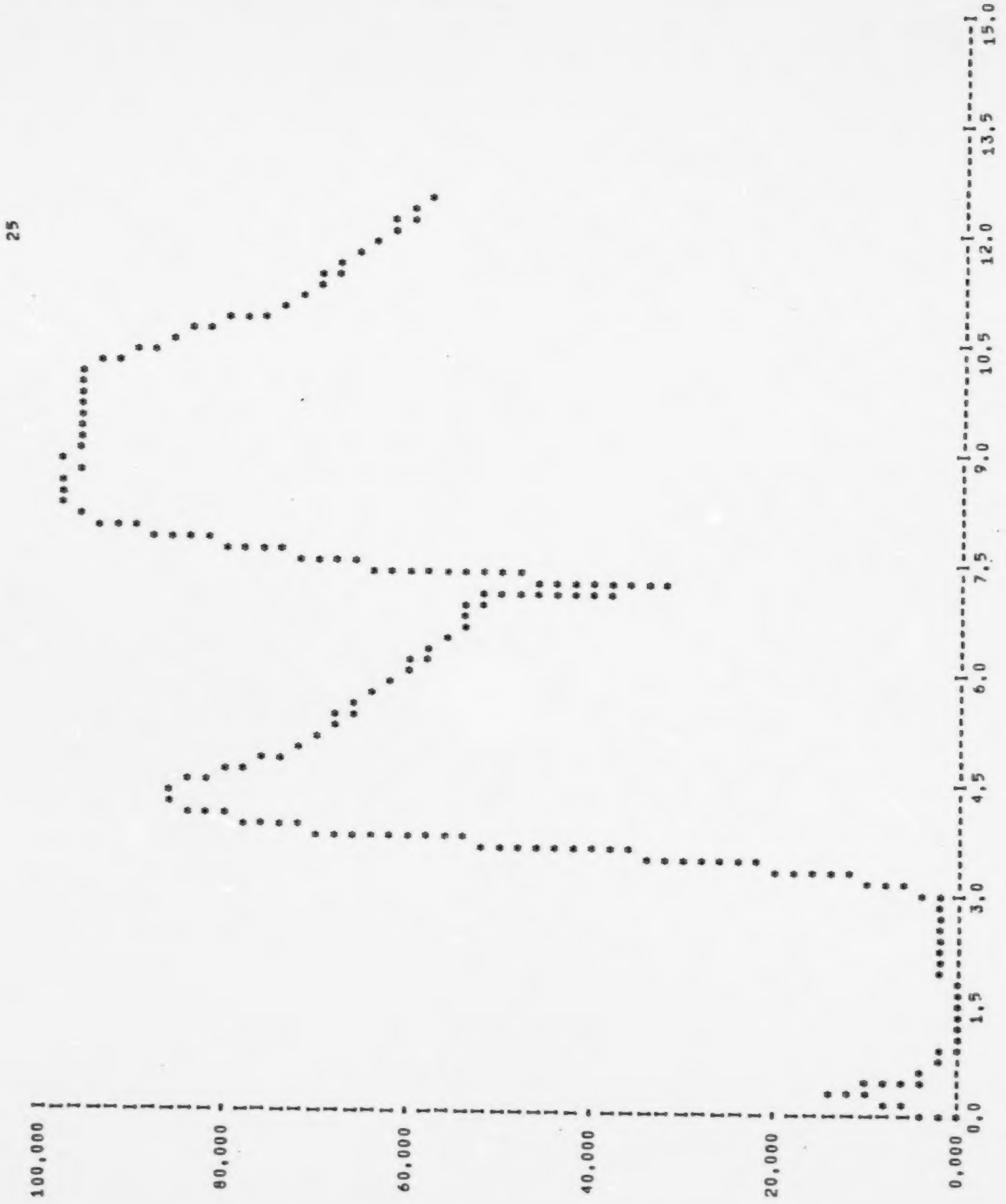
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COSTANAL BLOCK CALLED

COMPARISON OF COST BETWEEN NATURAL AND CONVENTIONAL
DRAINAGE SYSTEMS FOR EACH SUBCATCHMENT

SUBCATCH. NUMBER	COST ($/AC.)				AREA (AC.)		E.N.R. COST INDEX		COST ($)		COST RATIO
	CONV. SYST.	NAT. SYST.	R.O.W.	CLEARING	SUBCATCH.	R.O.W.	PAST	PRESENT	CONV. SYST.	NAT. SYST.	NAT./CONV.
1	2000.00	450.00	500.00	250.00	12.30	1.25	0.00	0.00	24600.	6472.	.26
2	1700.00	300.00	500.00	250.00	12.30	1.25	2300.00	2500.00	22728.	4948.	.22
3	1700.00	300.00	500.00	250.00	12.30	1.25	2300.00	2500.00	22728.	4948.	.22
4	1700.00	300.00	500.00	250.00	12.30	1.25	0.00	0.00	20910.	4627.	.22
5	1500.00	950.00	575.00	375.00	15.00	5.50	-0.00	-0.00	22500.	19475.	.87
6	1500.00	950.00	575.00	375.00	15.00	5.50	2300.00	2500.00	24457.	20714.	.85
TOTAL					79.20	16.00			137923.	61186.	.44